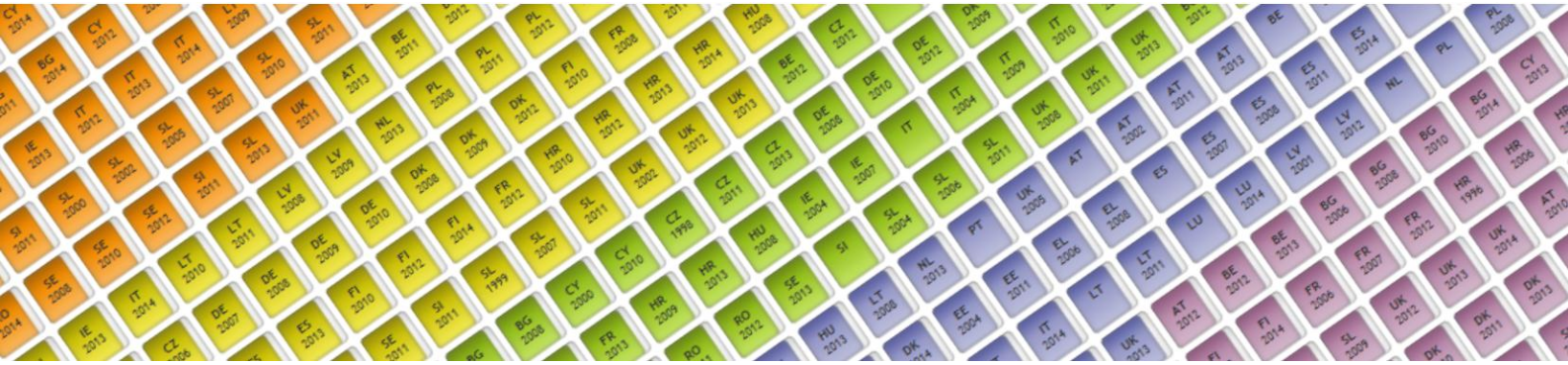
European Commission

JRC SCIENCE AND POLICY REPORT

RIO Country Report Estonia 2014

Ruuta Ruttas-Küttim

2015



Report EUR 27307 EN

Joint Research Centre

European Commission
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JRC 96487

EUR 27307 EN

ISBN 978-92-79-48967-9 (PDF)

ISSN 1831-9424 (online)

doi:10.2791/01066

Luxembourg: Publications Office of the European Union, 2015

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Abstract

The report offers an analysis of the R&I system in Estonia for 2014, including relevant policies and funding, with particular focus on topics critical for two EU policies: the European Research Area and the Innovation Union. The report was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The report identifies the structural challenges of the Estonian research and innovation system and assesses the match between the national priorities and those challenges, highlighting the latest policy developments, their dynamics and impact in the overall national context.

Acknowledgments

The report draft has benefited from comments and suggestions of Rein Kaarli from the Ministry of Education and Research and of Blagoy Kitanov from JRC-IPTS. The contributions and comments from DG RTD and JRC-IPTS are also gratefully acknowledged.

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Executive summary

This report was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative and qualitative data is, whenever possible, comparable across all EU Member State reports. The report provides an up to date overview of Estonia's R&I system (including funding), examining developments towards topics central to two EU policies – the European Research Area and Innovation Union.

Estonia is one of the smallest EU Member States accounting for ca 0.26% (about 1.3 million) of the population of the EU28 Gross Domestic Product (GDP) in 2013 was €18.4b (Eurostat, 2014). The growth in 2011 was 8.7%, but dropped back to 4.5% in 2012 and to 2.2% in 2013 (Eurostat, 2014) due to decline in external demand.

The overall level of R&D investments during the crisis in 2008-2009 showed growth as a percentage of GDP (from 1.28% to 1.4%), but had slight decline in absolute terms. The relatively stable financing was due to the previously committed Structural Funds, as R&D investments (GERD) dropped by only 5%, while GDP growth was -14%. In 2011 one could note significant growth (from 1.58 to 2.34%), mostly due to considerable R&D investments in shale oil refining industry, but as the building of the oil refinery was completed, R&D investments dropped back to 1.74% of GDP in 2013. The share of government sector investments (GBOARD) as a percentage of GDP has been increasing for the last five years (from 0.68% in 2009 to 0.85% in 2013) (Eurostat, 2014).

The research, development and innovation (RD&I) system in Estonia was mainly set up in the beginning of the 1990's when not only the legislation and institutions related to research and development (R&D) and innovation but the whole public functional system was created. Since 2000's, the basic principles of developing the R&D and innovation as well as policy and implementation system have remained the same in a broad sense.

Policy design and evaluation is carried out mainly by the Ministry of Economic Affairs and Communications (MEAC) and the Ministry of Education and Research (MER). However, universities and other R&D institutions are relatively independent in forming their own policies and setting research agendas. RD&I strategic objectives and principles of management and financing are defined in the RD&I strategy "Knowledge Based Estonia 2014-2020" and implemented by MER. Implementation of the "Entrepreneurship growth strategy for 2014-2020", which focuses on co-operation between enterprises and R&D institutions, is coordinated by MEAC. In the setting of priorities of these strategies, the methodology of smart specialization served as a basis, and key R&D areas were chosen in cooperation with private entrepreneurs.

ERAC Peer-review (2012) points out that the size of Estonia sets some limitations (the size of enterprises, the amount of financial and human capital available for RD&I), hence encouraging cross-sector co-operation (both in business and in government) and identifying a smaller number of focus areas that are systematically developed and receive a significant proportion of both public and private R&D investments, helps to tackle these challenges. Recommendations of recent evaluation on innovation support measures carried out by the Ministry of Economic Affairs and Communications (2012) also involve reducing the volume of non-reimbursable grants, enhancing funding options, and reducing the

proportion of individual grants and focusing more on supporting co-operation networks (clusters, co-operation between companies and universities, etc).

R&D and innovation are among the key priorities of Estonian Reform Programme "Estonia 2020" setting the objective of R&D investments in GDP on the level of 3% by 2020 (GERD 1.74% of GDP in 2013), of which the business sector investments would cover 2% of GDP by 2020 (BERD 0.72% of GDP in 2013) and public sector investments would cover 1% of GDP by 2020 (GBOARD 0.85% of GDP in 2013).

Estonia's position in Innovation Union Scoreboard (2014) improved in 2013 as compared to the previous year and is ranked 13th (two places below the EU27 average). Estonia is the highest growing Innovation follower. Estonia's Innovation performance has been increasing at a steady rate since 2007 although the growth rate has slowed down since 2009. The biggest problem is still the economic effect of innovation, where Estonia holds the 22nd position. Therefore, the main challenges for Estonia are creating a business environment necessary for increasing export intensity and employment in medium and high-tech industry and knowledge-intensive services.

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1. Overview of the R&I system

1.1 Estonia in the European RDI landscape

Estonia is one of the smallest EU Member States accounting for ca 0.3% (about 1.3 million) of the population of the EU28. Gross Domestic Product (GDP) in 2013 was €18.4b (Eurostat, 2014). The growth in 2011 was 9.6%, but dropped back to 3.9% in 2012 and to 1.3% in 2013 (Eurostat, 2014) due to decline in external demand. Except for 2008-2009, Estonian real GDP growth has almost always been above the real average EU27 GDP (now EU28) growth.

The input of shale oil refining industry helped to double total intramural R&D expenditure (GERD) in 2011 (in absolute terms) and GERD intensity reached 2.37% in 2011 (Eurostat, 2013). GERD declined to 2.18% of GDP in 2012 and further down to 1.74 in 2013, as the impact of investments to the shale oil refining industry disappeared.

Turnover from Innovation as % of total turnover was 13.7% in 2006, 10.2% in 2008 and 12.3% in 2010 (Eurostat 2014).

1.2 Main features of the R&I system

The Organisation of Research and Development Act provides the framework for the structure and financing of the Estonian research and development system. According to this law, the Government of the Republic prepares national R&D development plans, submits them to the Riigikogu (Parliament), approves national R&D programmes, ensures the cooperation between the ministries and enacts legislation.

As Estonia is a relatively small country, there is no regional decentralisation of the R&D system.

Policy design and evaluation is carried out mainly by the Ministry of Economic Affairs and Communications (MEAC) and the Ministry of Education and Research (MER). Other ministries are also responsible for organising and financing R&D activities, drafting and implementing R&D programmes of their area of responsibility.

RD&I strategic objectives and principles of management and financing are set in the RD&I strategy "Knowledge Based Estonia 2014-2020" and implemented by MER. The "Entrepreneurship growth strategy for 2014-2020", which focuses on co-operation between enterprises and R&D institutions, is implemented by MEAC. However, universities and other R&D institutions are relatively independent in forming their own policies and setting research agendas.

R&D funded by Business Enterprise Sector (% of GERD) was over 50% as a result of big investments into shale oil refinery in 2011 (55%) and 2012 (51.2%), but slid back to 41.3% in 2013; and the share of Government Sector financing changed accordingly from 32.8% in 2011, and 38.2% in 2012 to 48% in 2013.

1.3 Structure of the national research and innovation system and its governance

The main RDI funders are the Ministry of Education and Research (MER, ca 80% of funding) and the Ministry of Economic Affairs and Communications (MEAC, ca 14% of funding). MER is responsible for the funding of R&D (including applied and basic research) at R&D institutions and MEAC for funding applied research, technology development and innovation. The amount of funding of R&D through other ministries is relatively small, e.g. in 2013 it was less than 6% (Ministry of Finance, 2013).

A permanent **advisory body –** the **Research Policy Committee** - provides advice to the Ministry Education and Research and the **Innovation Policy Committee** advises the Ministry of Economic Affairs and Communications. The Research and Development Council (R&D Council) is an expert consultative body that advises the Government on R&D and innovation matters – all policy documents have to pass the R&D Council prior to being submitted to the Government for approval.

An innovation oriented projects promoter is the Development Fund, a public law entity, established by the Estonian Parliament in April 2007. The aim of the Development Fund is to initiate and support changes in the Estonian economy and society that would accelerate modernisation of Estonian economic structure, lead to growth in exports and contribute to the creation of new jobs requiring high qualifications. For that purpose, the Development Fund (together with the private sector) performs risk capital investments into the starting and growth-oriented technology companies and carries out socio-economic and technology foresight activities.

At the operational level, both ministries have implementing agencies and intermediaries. The main implementing body under the Ministry of Economic Affairs and Communication is the Enterprise Estonia Foundation, which is responsible for managing business support, innovation and technology programmes, etc. Foundation KredEx's mission is to facilitate the increase of competitive strength of Estonian companies by improving the availability of financing and managing credit risks, and the improvement of the energy efficiency in the housing sector by expanding financing possibilities and offering financing solutions aimed at promoting energy efficiency and increasing the use of renewable energy sources.

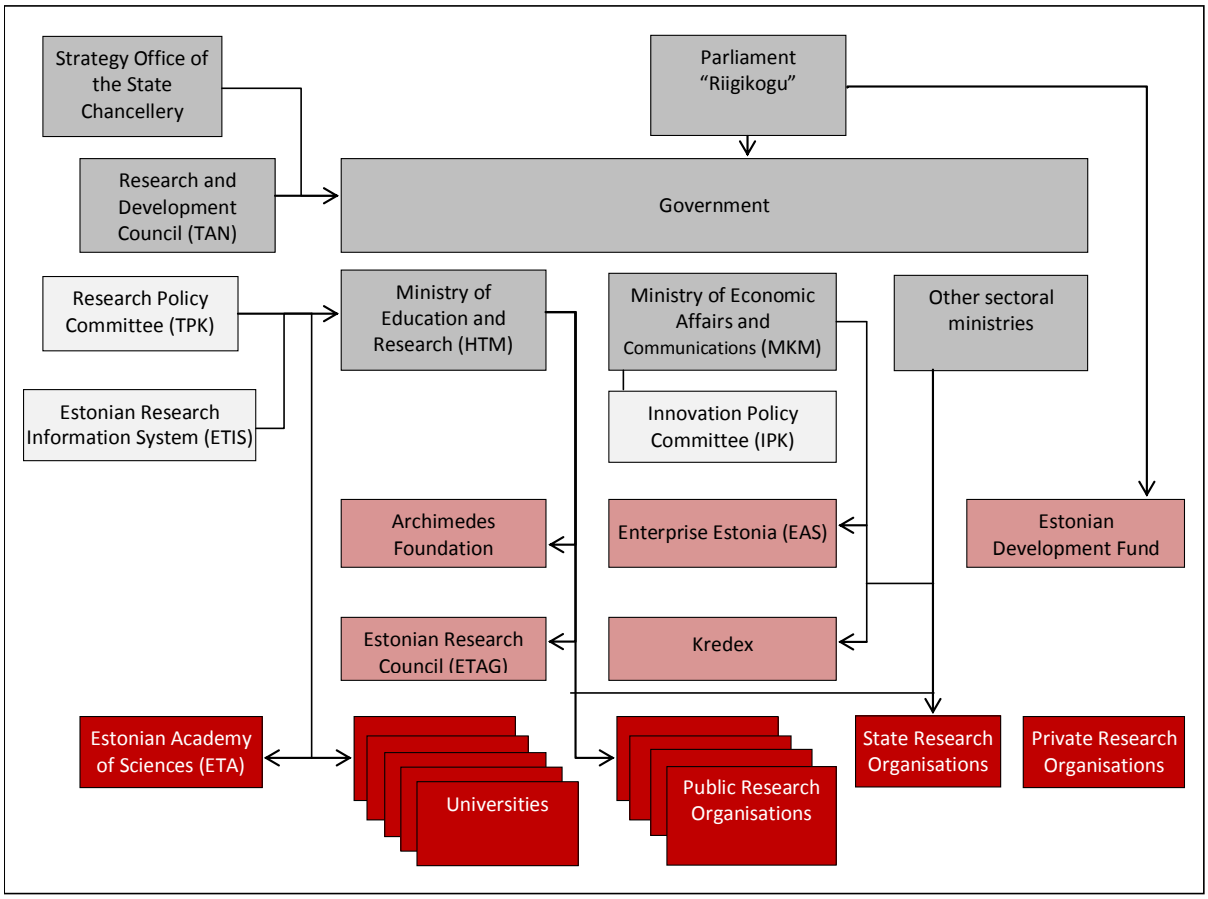
From the research policy perspective, the Ministry of Education and Research has three main agencies that among their other activities deliver funding and support: the Archimedes Foundation is implementing agency for structural support in the field of R&D and administers schemes for improving mobility and marketing Estonian higher education and research abroad. The Estonian Research Council was established in March 2012 to concentrate the funding of R&D and achieve better functioning of the financing systems. This body is the main funding organization of R&D, consolidating different grants and types of funding and giving research more visibility in the society. The INNOVE foundation manages a range of programmes and support measures in the fields of lifelong learning and active labour market policies.

The main players of Estonian research system are six public universities (one private university is focused mostly on education, not research). Research policy in Estonia is generally seen as covering university-lead research; and innovation policy as covering private sector lead research. This is largely due to the fact that nearly all basic research is conducted at universities and private sector focuses almost exclusively on product development and innovation.

The Ministry of Agriculture (MoA) is the only non-core ministry that has got a Research and Development Department and a budget line for R&D activities already for years, financing R&D on plant breeding, developing environmentally friendly and effective plant breeding technologies, rural economy and its sustainable development, research on the protection and monitoring of the agricultural environment, food safety, and biological diversity. In other ministries the R&D activities have been carried out sporadically to some extent, but the situation might improve, as the Implementation plan for R&D strategy indicates R&D activities (and related parts of budget) of the Ministry of the Environment, the Ministry of Defence, the Ministry of Internal Affairs, the Ministry of Culture, and the Ministry of Social Affairs.

There are around 400 companies actively conducting R&D in Estonia and around 10% of them account for most of the RD&I investments (ERAC Peer Review 2012). In the future, RD&I policy needs to address how to support the best-performing 10% and at the same time attract and assist the remaining 90% of domestic companies to get engaged with research and development work in order to move up in the value chain and to gain competitiveness. The share of SMEs innovating in-house as percentage of SMEs was 33.6% in 2010 (IUS 2014).

Figure 1. Structure of the Research and Innovation System



Source: ERAC Peer-Review of the Estonian Research and Innovation System, 2012; updated by the author.
Note: Estonian acronyms are given in brackets.

Main changes in 2014

In January 2014, the Parliament approved new RD&I strategy for 2014-2020 "Knowledge Based Estonia 2014-2020", which is Estonia's third strategy on research and development and innovation.
Estonian Research Infrastructures Roadmap was updated.
Amendments were made to the Organisation of Research and Development Act (in force from 01.01.2015): a) Most of temporary (5 years) contracts of research personnel are turned into permanent contracts and, as regular evaluation by election disappears, the evaluation of professional performance of research personnel must now take place at least once in 5 years; b) Until the end of 2014, detailed conditions and procedures for organising a competition for research staff in a research and development institution which operates as a state agency or a local authority agency, were established by the ministry or corresponding body of the legal person which governs a R&D institution. Since the beginning of 2015, R&D institutions can establish their own conditions of selection processes.

Main Changes in 2013

In October 2013, the Government approved the Entrepreneurship growth strategy for 2014-2020. The general goal of the strategy is to facilitate the achievement of the objectives within the national competitiveness strategy "Estonia 2020" to enhance productivity and employment.
In April 2013, Estonian Information Technology Foundation for Education (HITSA)[1] was established. The mission of HITSA is to provide a high-quality national network infrastructure for Estonia's research, educational and cultural communities.
Amendments were made to the Aliens Act in order to change the procedures for giving work permits with the objective of making it easier for potential top-level specialists and highly qualified employees to enter Estonia's labour market.

Main changes in 2012

In March 2012, Estonian Research Council (ESC), a new funding agency for Estonian research was established, which took over the functions of the Estonian Science Foundation and some functions of the Archimedes Foundation[2]. The aim of this reorganisation of functions of the ESC is to gather all R&D and research financing instruments 'under one roof' in order to create better synergy and avoid duplication and overlap (incl. in financing).
Amendments were made to the Organisation of Research and Development Act, to offer Ph.D. students an employment contract with the same social guarantees as any other employment. This will contribute to improving the attractiveness of doctoral studies.

Main changes in 2011

At the end of 2011, the Minister of Education and Research launched a reform of higher education and some amendments to the Organisation of Research and Development Act were made and a new Universities Act was adopted in 2012 with the aim to rearrange the financing of higher education, strengthen the quality and effectiveness as well as to increase fair accessibility of higher education.
Estonian Government approved the strategy "Estonia 2020", which sets the targets for 2020 and measures for addressing these challenges were taken into the Governments' workplan. (The strategy – also referred to as National Reform Programme - is updated annually.)

Main Changes in 2010

Estonian Government approved Estonian Research Infrastructures Roadmap 2010 (as annex of the RDI Strategy 2007-2013 Implementation Plan).

[1] From May 1st 2013, the Tiger Leap Foundation and the Estonian Education and Research Network were transferred to the Estonian Information Technology Foundation and the new name of established organisation is Information Technology Foundation for Education (HITSA; www.hitsa.ee)
[2] Research Cooperation Centre, a department of the Archimedes Foundation, acting as a FP7 National Contact Point, was transferred from Archimedes Foundation to the Estonian Research Council.

2. Recent Developments in Research and Innovation Policy and systems

2.1 National economic and political context

The national economy's growth in 2000-2008 was rapid but went into a decline from 2008 onwards, when the real Gross Domestic Product (GDP) growth rate was negative by -4.2% in 2008 and strongly negative -14.1% in 2009 (Eurostat, 2013). The growth was restored in 2010 (3.3%), reached 8.7% in 2011 due to increased exports, but slid back to 4.5% in 2012 and to 2.2% in 2013 as foreign demand fell. The recovery of Estonia's economy was driven mainly by exports. A very strong fiscal position also helped restore financial market confidence. However, economic growth started slowing in 2012 mainly due to weaker exports (OECD, 2015). Still, the average GDP per capita in PPS remains under the EU28 average – 72% in 2013, which leaves Estonia the recipient of full Cohesion policy support. Except for 2008-2009, Estonian real GDP growth has almost always been above the real average EU28 GDP growth (2.2% and 0.1% in 2013, respectively).

Estonia's strategic objectives for R&D, innovation and enterprise policy have been relatively stable over the last decade (since 2004). The structural weakness of the national economy remains, with a relatively lower share of high technology and knowledge-intensive companies. The input of shale oil refining industry helped to double total intramural R&D expenditure (GERD) in 2011 (in absolute terms) and for two years GERD intensity (2.34% in 2011 and 2.16% in 2012) exceeded EU28 average (1.97% in 2011 and 2.01% in 2012) but slid back below EU28 average in 2013 with 1.74%, as investments in the oil shale industry diminished (Eurostat, 2014). GERD intensity and its structure may have been affected by the recent crisis but the real impact has not been crucial for R&D development.

2.2 National R&I strategies and policies

The innovation governance system has remained basically intact and involves industry, parliament and the scientific community (see p 1.3). The present system is uncomplicated with a rather clear division of responsibilities and a firm connection with the political leadership (see Figure 1). RD&I strategic objectives and principles of management and financing are set in the RD&I strategy "Knowledge Based Estonia 2014-2020" (launched in January 2014). The "Entrepreneurship Growth Strategy 2014-2020" which focuses on co-operation between enterprises and R&D institutions, was launched in October 2013. While RD&I strategy focuses more on research and higher education, the "Entrepreneurship Growth Strategy" encompasses innovation and relevant educational aspects. Investments in research infrastructures are also planned under the strategies.

The strategies are supplemented by annually updated implementation plans that provide a predictable policy framework for short- and medium-term planning, via annual implementation plans, investment plans, etc (ERAC, 2012). Both strategies are preceded by international analyses of strengths and weaknesses, emerging opportunities ("smart specialisation") and market developments. The strategies also reflect EU priorities and exploit opportunities for joint programming, cross-border co-operation and the leverage effects of EU instruments (see measures 1-4 of R&D strategy implementation plan pp 12-13).

The main funding instruments are the state budget and EU structural funds. Policies and funding are focused on specific priorities, addressing societal challenges as identified in the Horizon 2020.

The 2007-2013 programming period is being completed and new measures are being initiated for 2014-2020, based on evaluations of previous period. As implementation plans of both strategies were just approved, it is still *too early to assess the impact* of these measures. While the previous RD&I strategies focused primarily on developing Estonia's capability in research, development and innovation, the new strategy aims to use the created potential for the good of Estonia's development and economic growth. In the setting of priorities the methodology of smart specialization served as a basis.

The RD&I strategy identifies four key goals:

- Research in Estonia is of a high level and diverse;
- Research and development (R&D) serves the interests of the Estonia's society and economy;
- R&D improves the knowledge-intensity of the structure of the economy;
- Estonia is active and visible in international RD&I cooperation.

The "Implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020" was approved by the Government in September, 2014. The implementation plan includes the following set of measures:

1) Ensuring the high level and diversity of research (12 sub-measures; total budget for 2014-2017 €400m[3])

In order to preserve high-level educational and cultural environment and shape a more desirable position for Estonia in the competition for location, it is necessary to increase the competitiveness of R&D and ensure diversity in covering the main fields. To this end, the organisation of research must preserve the quality-based financing of research, develop an attractive environment for research, and support autonomy and specialisation of institutions of higher education and research institutions. Investments in the development of human capital must be given preference, efforts should be made to ensure a new academic generation and to increase the number of researchers and engineers in the private sector, involving talented young people both from Estonia and abroad. The bureaucracy related to the measures for the EU Structural Funds should be simplified and reduced, and the number of measures themselves should be reduced. Support is given to research centres of excellence in performing *frontier research*[4].

2) Increasing the social and economic benefit of RD (13 sub-measures; total budget for 2014-2017 €85.67m)

Research in Estonia has reached the forefront in several fields on a global level, but it has been modest in achieving social and economic objectives. Cooperation between research institutions and enterprises should be significantly improved and also be open to new participants. The organisation of applied and socio-economic research should be carried

[3] Some overlapping of funds allocated for RD&I strategy and Entrepreneurship Growth Strategy is possible (eg.est. cooperation between enterprises and research institutions)

[4] RD&I Strategy 2014-2020: Measure 1.3: Support research centres of excellence in performing frontier research.

out systematically. The competence of the state as the body commissioning research and development should be increased.

3) Smart specialisation is the basis for RDI in changing the structure of economy (6 sub-measures; total budget for 2014-2017 €60.1m)

In the conditions where the state interferes with the economy as little as possible, one of the opportunities to affect the structure of the economy is the focussed support to carefully selected RDI fields and activities.

On the basis of an analysis organised by the Development Fund, based on the smart specialisation principles and made in cooperation between enterprises and research institutions, the following areas of growth were identified:

- Information and communication technology (ICT) horizontally through other sectors
- Health technologies and services
- More effective use of resources

The objective is to significantly improve the share of employment and added value of entrepreneurship in the economy and exports. Monitoring and activities will be initiated in each selected field of growth on the basis of an analysis of the bottlenecks.

4) Increasing the participation and visibility of Estonia in international RDI cooperation (6 sub-measures; total budget for 2014-2017 €42.7m)

Solving the major problems facing the state and mankind is so resource intensive that even big countries cannot cope with it alone - these therefore should be addressed in cooperation. Estonia must choose: what is it that we can do, and what is it we cannot – at least not at a sufficiently high level.

In international cooperation Estonia needs to make its contribution to solving the problems facing Estonia as well as the world, and to achieving the objectives of the European Union. Secondly, Estonian participation in international research programmes enables to bring in additional resources, new knowledge, demand and opportunities for the development of the high-technology economy of our country. The open research system of Estonia supports and encourages contacts between our researchers and their colleagues abroad since increasing international cooperation in research is a natural part of the development of research. Cooperation in research favours the other objectives of Estonia, incl. enhancing recognition and our reputation in the world.

The general goal of the “Entrepreneurship Growth Strategy 2014-2020” is to facilitate the achievement of the objectives within the national competitiveness strategy "Estonia 2020" to enhance productivity and employment. The main goals of the strategy are:

- Development of co-operation networks between enterprises and R&D institutions (including international co-operation);
- Development of demand-side policies (innovative public procurements, etc);
- Fostering start-up entrepreneurship.

The "Implementation plan for 2014-2017 for the “Entrepreneurship Growth strategy 2014-2020” (in Estonian) was approved by the Government in March, 2014, and includes the following set of measures:

1) Business model (total budget for 2014-2017 €18.85m):

- Creation of favourable conditions for new enterprises to emerge and develop;
- Enhancing the inflow of ambitious business ideas;
- The promotion of the creation and implementation of ambitious business models;
- Ensuring integrated and high quality entrepreneurial studies;
- Increasing the availability of capital for starting a business;
- Fostering the creation of spin-off enterprises;
- The improvement of management quality.

2) Development and production (total budget for 2014-2017 €45.19m):
   - Supporting the improvement of companies' development capacity and incentives to start new development projects;
   - Supporting the increase in profitability of the development;
   - Supporting the improvement of productivity.
3) Sales and marketing (total budget for 2014-2017 €7.5m):
   - Increase the number of exporting companies and their ability to enter new markets;
   - Support to entrepreneurs to enhance their export activities;
   - Promotion of export co-operation;
   - Supporting the reputation of Estonia as an innovative country.
4) Competitive position (total budget for 2014-2017 €160.96m):
   - Development of capital markets;
   - Better adjustment of the education system with the actual needs of enterprises;
   - Effective policy for attracting/maintaining talents;
   - Increase in foreign investment into development;
   - Simplification of the communication between the state and entrepreneurs by reducing the administrative burden;
   - Analyses of the possibilities for the development of the tax system;
   - Development and marketing of the image of Estonia.
   - Increasing the competitiveness of companies operating in creative industries
5) Creating favourable conditions for (smart specialisation) growth areas (total budget for 2014-2017 €53.48m):
   - Developing co-operation networks;
   - Developing demand-side policies;
   - Promoting start-up enterprises.

According to the Implementation plan for RD&I strategy 2014-2020, the balance between generic and thematic/sectoral R&D funding will be in favour of generic funding – 10% of all R&D funding (2014-2017) is allocated for Smart Specialisation, where a clear thematic focus is evident.

To optimise research programmes and priorities in Estonia, the RD&I Strategy for 2007-2013 focused on seven key areas: three programmes have a technological focus (ICT, biotech and material technologies) and four are *focusing on societal challenges* (energy, defence and security, health care and welfare services, environmental protection and technology). Six national programmes (ICT, biotechnology, energy, national defence and security, environmental protection and technology, health promotion research programme) were implemented. Based on the feasibility study (MEAC2, 2011), a full-scale programme in materials technology was not launched, but an open call was held as a provisional programme. According to the "Report on achieving the objectives and implementing the strategy in 2012", the total budget for all programmes was about €51m[5].

2.3 National Reform Programmes 2013 and 2014

The National Reform Programme "Estonia 2020" (updated in May 2014) sets two central objectives of "Estonia 2020" – increasing productivity and employment in Estonia. The main focus in the coming years is on education and employment and the main objectives include integrating long-term and young unemployed people in the labour market and developing their skills.

As reported in the "Assessment of the 2014 national reform programme and stability programme for Estonia" (EC 2014), Estonia has continued to make progress in promoting entrepreneurship. Training in various aspects of entrepreneurial activities is available at all levels of education and is being promoted alongside initiatives to increase the popularity of the sciences. Some private entities have been running successful accelerated programmes and the University of Tartu opened an Entrepreneurship Centre teaching science, technology, engineering and mathematics and also collaborating with entrepreneurs in various fields. If these measures continue to be implemented systematically and continue to receive sufficient funding, they have the potential to increase the number of successful entrepreneurs and transform Estonia into a 'start-up hub'.

Estonia's smart specialisation framework comprises the Entrepreneurship and Growth Strategy (adopted by the government in October 2013) and the Research, Development and Innovation Strategy (adopted by the Riigikogu in January 2014) with a focus on shared priorities while further specialising in the thematic areas. Efforts should be continued towards the internationalisation and prioritisation of the research, development and innovation system, given the small size of the economy (European Commission, 2014c).

Internationalisation and synergies between research, development and innovation are also of high importance for promoting technological development, increasing productivity and strengthening competitiveness.

[5] Budget is given for programme period (most of programmes implemented 2012-2015). Annual data is not available.

The amendments to the Universities Act, which came into force in 2013, have changed the financing model of universities, with the aim of providing financial incentives for attracting more students to science, technology, engineering and mathematics. The measures taken seem appropriate and could prove effective. Attracting international students and highly qualified specialists from countries outside the EU to Estonia has been facilitated by amendments to the Aliens Act adopted in autumn 2013. According to the NRP, although the objective to admit 2,000 foreign students by 2015 has been achieved, measures that support internationalisation will be continued.

Estonia has made some progress in addressing the recommendation to identify potential measures to prioritise and internationalise research and innovation systems and improve cooperation between businesses, higher education and research institutions. Estonia has identified the knowledge-intensive sectors that could move the country's economy up the value chain and thus allow it to become competitive at global level.

The Smart Specialisation Framework comprises the Entrepreneurship Growth Strategy adopted by the government in October 2013 and the RD&I Strategy adopted in January 2014. Synergy in the implementation of the two strategies remains critical for stimulating private RD&I investment in Estonia. The innovation vouchers programme – a first step towards fully-fledged R&D activities – has proved successful in increasing the number of contracts between research providers and companies.

2.4 Policy developments related to Council Country Specific Recommendations

The EC country specific recommendation (of 2014) on R&D in Estonia is to "further intensify prioritisation and specialisation in the research and innovation systems and enhance cooperation between businesses, higher education and research institutions to contribute to international competitiveness" (European Commission, 2014a).

According to the Assessment of the 2014 national reform programme and stability programme for Estonia (EC 2014), Estonia's labour productivity remains relatively low and would benefit from a further increase in capital stock per worker (79% of the EU15 average in 2012) and greater investment into technological development (stock estimated at 63% of the EU15 average in 2012). Although Estonia made a large leap forward in innovation in 2012, the country's performance is still below average in this area and ranks only 22nd on the new EU indicator of innovation output. The number and share of companies undertaking development and innovation activities is still low. Cooperation between business and the academic world is improving, but only slowly. Fragmented R&D measures have had a less pronounced impact than expected in terms of encouraging companies to use universities' research facilities and some measures have reportedly increased the administrative burden on companies. Both the inadequate legal framework for protecting intellectual property and the university financing system tend to discourage universities from becoming more active in R&D and from increasing the number of contracts entered into with companies.

Estonia has made some progress in addressing the recommendation to identify potential measures to prioritise and internationalise research and innovation systems, and improve cooperation between businesses, higher education and research institutions. Estonia has identified the knowledge-intensive sectors that could move the country's economy up the

value chain and thus allow it to become competitive at global level. The Smart Specialisation Framework comprises the Entrepreneurship and Growth Strategy adopted by the government in November 2013 and the Research, Development and Innovation Strategy adopted in January 2014. Synergy in the implementation of these strategies remains critical for stimulating private RD&I investment in Estonia (European Commission (2014c).

In 2013, Estonia received a recommendation on research and innovation systems and co-operation between businesses and the academic world. The analysis in staff working document Assessment of the 2014 national reform programme and stability programme for Estonia leads to the conclusion that Estonia has made some progress in addressing the recommendation and measures appear relevant and credible.

2.5 Funding trends

2.5.1 Funding flows

RD&I strategic objectives are set in the RD&I Strategy "Knowledge-based Estonia" (new strategy for 2014-2020 launched in January 2014). The target towards total R&D investments (GERD) in 2020 is set on 3% of GDP and business sector R&D investments (BERD) on 2% of GDP.

The overall level of R&D investments as a percentage of GDP almost doubled in 2008-2011 (from 1.26% to 2.34%), but slid back to 2.16% on 2012 and dropped again below EU28 average in 2013 (EU28: 2.02%; EE: 1.74%) as the effect of the investments to the shale oil refinery ended. The business sector investment (BERD) as a percentage of GDP follows the same trend (as the cause is the same): it tripled in 2008-2011, slid back in 2012 and dropped further by about 50% in 2013. The share of government sector investments (GBOARD) as a percentage from GDP has been growing steadily for the last five years (from 0.69% to 0.86%) (Eurostat, 2014).

Gross expenditure on R&D (GERD) in absolute terms has tripled in 2004-2010 and doubled in 2010-2011. As a percentage of GDP it was above the EU average in 2011-2012, but dropped back below EU average in 2013 as investments in shale oil refinery ended. During the crisis in 2008-2009, R&D investments showed an increase as a percentage of GDP (as a consequence of GDP decline) but had a slight decline in absolute terms. The relatively stable financing was due to the previously committed Structural Funds (GERD dropped by only 5%, while GDP change by -14%).

In the business enterprise sector, investments dropped by 1.9% during the crisis, but doubled in 2011 compared to 2010, and in 2011 Business Expenditures on Research and Development (BERD) results in 1.5% of GDP. In 2011-2012 one could note a significant growth in BERD, mostly due to big R&D investments in shale oil refining industry. Although this effect faded and BERD declined to 1.08% of GDP in 2012 and to 0.68% in 2013, BERD in absolute terms doubled from 2009 to 2013.

GBAORD as % of GDP is 0.86% above the EU average (0.69% in 2013) and as a share of general government expenditure reached 2.24% in 2013 (EU28: 1.41%). The higher education sector performed 42.32% of GERD in 2013 (EU28: 23.19%). From 2009 to 2011 the share of HEIs declined from 43% to 28%, but returned to 32% in 2012 and to 42% in 2013, as business sector investments declined.

The share of EU Structural funds has been growing remarkably from 2009 to 2013. In 2011 and 2012, 64% and in 2013 60% of all public sector RD&I funding was financed under Structural Funds (including co-financing from the state)(Ministry of Finance, 2012, 2013). As the funding from the structural funds has been specifically targeted for infrastructure development, mobility schemes and internationalisation, the possibilities to use it for other general needs, such as researchers' salaries, maintenance costs and indirect costs was limited (ERAC, 2012).

During the European Union´s multiannual financial framework 2007-2013, education, research and development were financed by a total of €763m, of which the support of European Social Fund was €159m and of European Regional Development Fund €523m (MER official site, 2015). In Estonia, the funding was based on the Operational Programme for Human Resource Development. In the framework of the Operational Programme for the Development of Economic Environment, higher education and university infrastructure development, research equipment acquisition, and scientific centres of excellence were supported. For three Operational Programmes (Human Resource Development - ESF; Development of Economic Environment - ERDF+CF; Development of Living Environment - ERDF+CF), the total structural support for Estonia was €3.4b and the share for R&D and higher education was 12% (Must, 2013).

Support measures for enterprises to develop new products, services and technologies are financed from the Enterprise Estonia support scheme for R&D projects. The total budget of this measure was €60m for 2007-2013 (MER, 2013a).

Table 1: Basic indicators for R&D investments (data up until the last available year).

	2009	2010	2011	2012	2013	EU28 (2013)
GDP growth rate	-14.1	3.3	8.7	4.5	2.2	0.1
GERD (% of GDP)	1.4	1.58	2.34	2.16	1.74	2.02 (2012)
GERD (euro per capita)	147.3	173.7	287.7	284.9	n/a	530.1 (2012)
GBAORD - Total R&D appropriations (€ million)	96.36	102.76	125.9	145.83	157.94	90,505.611 (2012)
R&D funded by Business Enterprise Sector (% of GDP)	0.54	0.69	1.29	1.11	0.72	1.1 (2012)
R&D funded by Private non-profit (% of GDP)	0.01	0	0	0	0	0.03 (2012)
R&D funded from abroad (% of GDP)	0.16	0.18	0.28	0.22	0.18	0.2% (2012)
R&D funded by Framework Programmes (€ million)[6]	11.3	10.2	6.7	9.5	n/a	n/a
R&D funded by the Structural funds (€ million)[7]	n/a	18.3	54,2	68.0	66.8	n/a
R&D related FDI (€ million) [8]	-6,608	2,781	0,46	1,037	n/a	n/a
R&D performed by HEIs (% of GERD)	42.16	38.0	27.8	32.1	42.32	23.6% (2012)
R&D performed by Government Sector (% of GERD)	10.99	10.55	8.1	9.3	8.93	12.2% (2012)
R&D performed by Business Enterprise Sector (% of GERD)	44.69	50.16	63.17	57.53	47.69	63.3% (2012)
Share of competitive vs. institutional public funding for R&D[9]	69 vs. 31	69 vs. 31	69 vs. 31	n/a	n/a	n/a
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	4.1	3.5	4.4	4.2	4.1	5.6% (2012)
Employment in knowledge-intensive service sectors as share of total employment	35.1	35.3	34.3	35.0	35.5	39.2% (2012)

	2004	2006	2008	2010	EU27 (2010)
Turnover from Innovation as % of total turnover	11.9	13.7	10.2	12.3	13.4

[6] EU financial contribution in retained proposals (in € million). Source : Sixth FP7 Monitoring Report (European Commission, 2014)

[7] Source: Estonian Research Council website (ETAG, 2015). http://www.etag.ee/analuus/statistika/teadus-ja-arendustegevuse-rahastamine-eestis/ .

[8] FDI flows by industry (R&D), inward, in € million. Source: OECD 2014

[9] Source: ERAC Peer-Review (2012)

2.5.2 Project vs. institutional allocation of public funding

The main bodies through which RD&I is funded are MER and MEAC. MER is responsible for the funding of R&D (including applied and basic research) at R&D institutions and MEAC for funding applied research, technology development and innovation. According to ERAC Peer Review (ERAC, 2012), the main R&D funding instruments in MER budget (70 %) and most of the funding from MEAC budget are allocated on a competitive basis. The share of competitive versus institutional funding in the R&D national budget of MER was 69% and 31% respectively in 2011 (ERAC, 2012) or even 80% vs 20% (Koppel, 2014).

Most of the R&D funding from the budget of the Ministry of Economic Affairs and Communication (12% of total R&D budget in 2012) is provided on a competitive basis and MEAC funding instruments include a very high share from the EU Structural funds (ERAC, 2012). The amount of funding of R&D through other ministries is small (7% in 2012). Overall, four largest RD&I funding instruments envelope ca 40% of total public funding. In absolute numbers, government funding increased from €104m in 2008 to €145m in 2012.

The main RD&I policy instruments in MER are (Estonian Research Council, 2015):

- baseline funding of evaluated R&D institutions, based on R&D quality and outcome (5% of total Govt. funding in 2013);
- Institutional funding (targeted financing of research topics of evaluated R&D institutions, competitive institutional grant for research groups) (23% of total Govt. funding in 2013);
- personal research funding (individual R&D grants, competitive) (6% of Govt. funding in 2013);
- support towards maintenance of the R&D infrastructures (5% in 2012, n/a for 2013[10])

This share of financing from MER budget has remained almost the same since 2007 when the 2007-2013 financing framework was approved by the Government within the state budget strategy. Although the titles of funding instruments were changed within the reform in 2011-2012, the shares have changed little.

The discontent with very high share of competition-based funding (ca 80%) in the present model of financing has been aired since the new system was introduced in 2012. In the end of 2014, a working group was set up to formulate proposals for improving the R&D funding system. The proposals were presented in the beginning of January 2015 and suggest that the current "triple breakdown" into institutional research funding, personal research funding and baseline funding should be replaced by a "dual breakdown", which would consist of stable operating subsidies to research institutions and competition-based research grants. Their proportion should be shifted from the existing ratio of 20:80 to 50:50 (MER news, 5.01.2015).

Institutional funding

The criteria for allocating block funds for RDI institutions are set in the Organisation of Research and Development Act (introduced in 1997, last update in 2012). *Baseline funding*

[10] After introducing the *institutional funding* scheme, some of infrastructure maintenance costs are allocated via that instrument.

is allocated to R&D institutions if they have received a regular positive evaluation[11] (Riigi Teataja, 2010). *Infrastructure expenses* and *institutional research funding* are allocated to institutions whose research and development activities have received a regular positive evaluation in at least one field. To carry out regular evaluation of R&D institutions, the Minister of Education and Research shall form a 3-16-member evaluation committee consisting of foreign experts in the various fields and approve its working procedure (Riigi Teataja, 2012).

A new funding instrument is competitively allocated institutional research funding (relevant amendments made to the Organisation of Research and Development Act in 2012). The evaluation of the institutional research funding applications is organized by the Estonian Research Council.

The assessment is performed by the Estonian Research Council's evaluation committee by means of international peer review. The implementation of the institutional research funding has been challenging and still needs some adjustments (Koppel, A., 2014).

Project funding

The Estonian Research Council (established in 2012) awards institutional and personal research funding (relevant amendments to the Organisation of Research and Development Act are in force since 2012). *Institutional research funding* is funding allocated for high level research and development and related activities (research topics) of a research and development institution and for ensuring the consistency of research and development in a research and development institution. *Personal research funding* is funding allocated for a high level research and development project of a person or a research group working in a research and development institution, including the research scholarship of Master's students and Doctoral candidates and funding allocated in support of research carried out by post-doctoral fellows.

The core set of measures to enhance competitive funding through calls for proposals and evaluations of research and development activities of R&D institutions has been in place since mid-1990ties[12]. Involving foreign experts is a common rule in evaluating also personal research funding and institutional research funding.

2.5.3 R&I funding

Two ministries are mainly responsible for RD&I. In general, MER is responsible for research area and MEAC is responsible for innovation. In 2013, the share of MER in the total R&D budget (€169m in absolute terms) was 80% (83% in 2012) and the share of MEAC was 14% (12% in 2012). The amount of funding of R&D through other ministries is small, e.g. in 2013 it was less than 6% (Ministry of Finance, 2013).

[11] 50% in proportion with the number of high level publications in internationally recognised journals, the number of high level research monographs and the number of registered patents and patent applications; 40% in proportion with the amount of financing of research and development from other sources i.e. targeted research, commissioned by enterprises, municipalities, ministries etc; 10% in proportion with the number of Doctoral graduates.

[12] Relevant laws: Organisation of Research and Development Act (introduced in 1997) and 2014-2020 Structural Assistance Act (introduced in 2004 for each programming period)

The share of public funding of R&D was bigger than the share of business sector funding until 2011, when large investments into oil shale industry changed the balance and GERD funded by business sector doubled, reaching 1.3% of GDP (GERD funded by government was 0.78% of GDP). In 2012 the effect oil shale industry related investments faded and BERD declined to 1.08% of GDP in 2012 and to 0.68% in 2013. Still, BERD in absolute terms doubled from 2009 to 2013 and compared to 2011, R&D expenditure increased almost 1.5 times in information and communication (ca 29% of total intramural R&D expenditure in 2013) and in professional, scientific and technical activities (ca 22% of total intramural R&D expenditure).

No tax incentives have been given to the R&D and innovation investments except that the companies' income is free of taxation to the extent that they reinvest their profit. There are no instructions whether the reinvestment has to be made in R&D and innovation or into something else, the only criteria are for the investments to be made into the development of the company. The tax policy of the Government of Estonia follows the rule of taxing everything similarly and allowing as few exemptions as possible – consequently, the idea of specific tax incentives for R&D and innovation expenditures has not been supported by the Government so far.

MEAC supervises support for and funding of business sector R&D and is responsible for funding applied research, technology development and innovation. The main implementing body of MEAC is the Enterprise Estonia Foundation, which is responsible for managing business support, innovation and technology programmes. Foundation KredEx's mission is to facilitate the increase of competitive strength of Estonian companies by improving the availability of financing and managing credit risks, and the improvement of the energy efficiency of the housing sector by expanding financing possibilities and offering financing solutions aimed at promoting energy efficiency and increasing the use of energy from renewable sources.

Government support to private sector R&D is mainly direct funding via competitive grants. Support measures for enterprises to develop new products, services and technologies are financed from the Enterprise Estonia support scheme for R&D projects. The total budget of this measure was €60m for 2007-2013 (MER, 2013a). Examples of innovation-oriented support measures provided via Enterprise Estonia include R&D grants, Innovation Voucher grant and Involvement of innovation staff (see also p.4.4). In addition, venture capital investments via Estonian Development Fund could be counted as innovation funding.

Since 2001, public support given to develop innovation policy has been mainly given in the form of grants. The size of the grant varies according to the requirements and conditions of the measure and the legal status of the applicant. Almost in all cases the grants are subject to the European Union state aid rules, mainly de minimis or block exemption.

2.6 Smart Specialisation (RIS3)

To date, there is no separate national or regional R&I strategy on Smart Specialisation and there is no plan to have one, as Smart Specialisation has been incorporated into the RD&I Strategy 2014-2020 and into the Entrepreneurship Growth Strategy 2014-2020. Monitoring and evaluation of Smart Specialisation is a regular part of monitoring process of these strategies. The budget for Smart Specialisation in 2014-2020 (including structural

funds and state budget co-financing) is planned to be about €140m (Estonian Development Fund, Feb. 2015).

In the end of 2012, the Estonian Development Fund completed the first phase (Qualitative Analysis of Smart Specialisation) of the analysis and the areas of Smart Specialisation were selected. In June, 2013, the work on a follow-up was completed (Analysis of deficiencies and new opportunities) and specific bottlenecks were identified that need to be dealt with in order to increase innovation. The second part of analysis focused on practical recommendations and actions to overcome the obstacles in Estonia's innovation. These analyses were commissioned by the Ministry of Economic Affairs and Communications and the Ministry of Education and Research.

The growth areas were selected, using OECD/European Commission Smart Specialisation methodology. The analysis was performed in cooperation with Enterprise Estonia, Estonian Research Council, and leading economists.

Smart Specialisation growth areas are:

- ICT supporting other sectors (use of ICT in industry incl. automation and robotics, cyber security, software development);
- Health technologies and services (biotechnology, e-health);
- Resource efficiency (material science and industry, knowledge-based construction, health-promoting food industry, chemical industry).

2.7 Evaluations, consultations, foresight exercises

Organisation of Research and Development Act indicates two types of external evaluations of research and development:

- Regular evaluations (introduced in 1995) for assessing the level of the corresponding field of research and development at a research and development institution. The period of validity of a positive decision of a regular evaluation is 7 years,

- Targeted evaluations (introduced in 2009) for preparing field development plans that guide research and development or other research policy decisions and measures, or for assessing and analysing the impact and implementation thereof. MER has the right to organise evaluation at its own initiative or upon proposal of other ministries.

A research and development institution has the right to apply for financing of its research and development activity from the state budget in the case when its research and development activities have received a regular positive evaluation in at least one field. To carry out regular evaluation of R&D institutions, the Minister of Education and Research shall form a 3-16-member evaluation committee consisting of foreign experts in the various fields, and approve its working procedure (Riigi Teataja, 2012).

In the process of preparation for the new research, development and innovation (RDI) strategic period of 2014–2020, MEAC and MER asked the European Research Area Committee (ERAC) for an external evaluation of the policy mix. The ERAC Peer-Review of the Estonian Research and Innovation System: Steady Progress Towards Knowledge

Society (2012) pointed on the following aspects concerning the governance and funding of research and innovation in Estonia[13]:

- Innovation policy seems high on the Estonian policy agenda and RD&I policy is systematically planned, however there is a need for more active RD&I policy coordination. Apart from the MER and MEAC, other ministries are not permanently represented in the Research and Development Council, the Research Policy Committee[14] or the Innovation Policy Committee.
- The connection between sectoral ministries, societal stakeholders and the core RD&I system is insufficient. Also, the participation and activity of other stakeholders and societal partners (entrepreneurs, civil society organisations) in advisory bodies is low and thereby limits the capability of advisory bodies and stakeholders to define the social demand for RD&I policy.
- The implementation of research and innovation policies is fragmented and therefore multiple foundations and agencies implement policies through partly overlapping funding instruments. Some industrial RD&I projects were funded from different sources as separate projects during the life time of the idea to the market. This poses a hurdle for applicants and results in large project administration overheads and reduced impact of funding.
- There is a need to strengthen ownership and implementation of national RD&I programmes. Currently there is lack of clear 'ownership' for the national RD&I programmes, which makes their implementation challenging.
- There are relatively few evaluations for RD&I programmes and instruments, even for the few that are executed by the ministries themselves. Better monitoring of the progress and assessment of impact of programmes and other RD&I support measures is needed. The establishment of the Estonian Research Council in 2012 and its monitoring and evaluation responsibilities is a welcome introduction to this end.

To solve the problems listed above, the RD&I Strategy for 2014-2020 aims to (MER, 2013a):

- Focus specifically on existing large-scale support schemes, including analysing possibilities for replacing current direct grant support actions gradually with increased use of financing instruments.
- Set clearer focus on national RD&I programmes – national RD&I programmes are one of the main instruments in implementing strategic priorities, therefore, national programmes need to be clearly connected with strategic priorities – reduce their number and make implementation more efficient.
- Focus on a limited number of growth areas, on the basis of the Smart Specialisation concept. These fields need to be given priority in coordinated development using

[13] Other recent studies have made similar conclusions (MEAC, 2012: Estonia's enterprise and innovation policy's evaluation 2012; National Audit Office, 2012: Activities of the state in promoting key areas of research and development; MER, 2013: Report on achieving the objectives and implementing the strategy in 2012)

[14] From March 2012, the Ministry of Finance, Ministry of Social Affairs, and Ministry of Agriculture are represented in Research Policy Committee https://www.riigiteataja.ee/akt/313032012001

research and development and innovation as well as enterprise policy measures in cooperation with sectoral ministries;

- Ensure competent human resources – limited human resource is one of the main obstacles in developing Estonia's economy and society. Therefore, opportunities need to be found for improving involvement of the people we have, increasing their competences, as well as attracting and bringing in additional competences from abroad.
- Enhance connectivity of RD&I system internally as well as externally – one of the objectives of the new strategy is enhancing national as well as international cooperation of Estonian R&D institutions and enterprises. In order for Estonia to benefit from the results of joint initiatives and have better perspectives to implement these results for the prosperity of our economy and society, there has to be better interconnection with European Research Area initiatives (including joint programming initiatives, European Innovation Partnerships, Baltic and Nordic cooperation), possibilities ensured for Estonian participation in pan-European R&D infrastructures.

To analyse thoroughly the impact of 2007-2013 policy measures and give policy recommendations for implementation of the RDI Strategy "Knowledge-based Estonia 2007-2013" and to design both – the new Estonian RDI strategy (2014-2020) and policy measures under the strategy, the Research and Innovation Policy Monitoring Programme for 2011-2015 (TIPS Programme) was launched in 2011. The programme activities are grouped into seven Work Packages (so far altogether 19 reports have been compiled):

- Intellectual property rights in research and development (2 reports);
- Public funding of research activities in Estonia (4 reports);
- Leadership and management models of Estonia's research and development institutions (2 reports);
- Management of cooperation between higher education institutions and industry (4 reports);
- Complex analysis of research, development and innovation policy (2 reports);
- Internationalisation of research, development and innovation activities (2 reports);
- Designing the Estonian research, development and innovation strategy for 2014-2020 (3 reports).

The Estonian Development Fund completed two surveys on Smart Specialisation (Qualitative Analysis of Smart Specialisation in 2012 and Smart Specialisation: Analysis of deficiencies and new opportunities in 2013) and their findings have been used to design the RDI strategy 2014-2020 and the Entrepreneurship Growth Strategy 2014-2020 and their respective implementation plans.

MEAC, Enterprise Estonia and KredEx carried out evaluations of enterprise and innovation policy, to assess the measures implemented and the impact, effectiveness and feasibility of those measures: Interim evaluation of the cluster programme (2013, summary in English) and Mid-term evaluation of innovation and enterprise support policies[15] (2014,

[15] R&D related conclusions: R&D grant has allowed companies to reach commercialisation more easily compared to the earlier assessment, but company volumes are still small; Three-quarters of companies active in the field of R&D took their product innovations to market and two out of three did it thanks to the

summary in English). The findings have been used to design Entrepreneurship Growth Strategy 2014-2020 and its implementation plan.

Estonia does not have a specific macroeconomic model to assess R&I impact on economic growth.

support of EAS; Of all R&D investments in private sector, 90% were made with the support of EAS; The R&D grant award was rated the most positive with the strongest effect; Every fifth recipient of an R&D grant award has since terminated its activities.

3. National progress towards realisation of ERA

3.1 ERA priority 2: Optimal transnational co-operation and competition

Increasing the participation and visibility of Estonia in international RDI cooperation is one of the key objectives in the new RD&I Strategy for 2014-2020, which also focuses on the three growth areas of Smart Specialisation (ICT supporting other sectors; health technologies and services; resource efficiency). The Implementation plan for RD&I strategy (MER, 2014b) includes specific actions to analyse options to ensure the openness of Estonia's research and development programmes for international cooperation and to develop cooperation opportunities with third country researchers and research institutions.

Most of joint financing actions are regulated by the 2014-2020 Structural Assistance Act (Riigi Teataja, 2014b) and by the Organisation of Research and Development Act and related acts and procedures, designed for specific measures and funds. Regulations for allocating competitive public funds always define priorities, selection criteria and procedures, reporting requirements, eligibility criteria, definition of eligible costs, intellectual property rights, standards for proposal evaluation, funding rates, etc. Joint financing is welcome and project partners are selected based on excellence, not on country of origin. Universities and other R&D institutions are independent and can choose their partners from any country in the world.

To carry out regular evaluation of R&D institutions, the Minister of Education and Research shall form a 3-16-member evaluation committee consisting of foreign experts in the various fields and approve its working procedure) (Riigi Teataja, 2012). Involving foreign experts has been common rule in evaluating R&D institutions since 1995 and has also been applied also on personal research funding and institutional research funding (in force since 1990 and since 1997, respectively).

The Estonian Research Infrastructures Roadmap (2014) itemises national interest in specific ESFRI projects, but does not deal with rules on access to facilities. Indirectly, mobility programmes provide access also to the infrastructure. While updating Infrastructure Roadmap in 2013, Estonia had quite comprehensive consultations with Finland, as Finland also updated their Research Infrastructure Roadmap. Swedish experts were also involved in the process of selection of infrastructure objects for the Roadmap.

According to the Estonian Research Infrastructures Roadmap, Estonia will participate in the following ESFRI projects: The European Life-Science Infrastructure for Biological Information (ELIXIR); European Spallation Source (ESS); Biobanking and Biomolecular Resources Research Infrastructure (BBMRI); Common Language Resources and Technology Infrastructure (CLARIN); European Social Survey (ESS ERIC); European Infrastructure for Translational Medicine (EATRIS ERIC).

International co-operation projects are funded by the Estonian Research Council in the framework of either bilateral (the PARROT programme with France, memoranda with the Russian Humanitarian Scientific Foundation and the US Civilian Research and Development Foundation) or pan-European initiatives (EUROCORES, ERA-NET, ARTEMIS, EMBO). There are agreements in place with the Baltic and Nordic partners and several exchange programmes, such as Norwegian-Estonian Research Cooperation Programme for 2009-2014 and the Nordplus Programme of eight participating countries in the Baltic and Nordic regions.

3.2 ERA priority 3: An open labour market for researchers. Facilitating mobility, supporting training and ensuring attractive careers

3.2.1 Introduction

Estonia's universities and other R&D institutions are relatively independent in forming their HR policies. The basic rules are set in the Organisation of Research and Development Act (introduced in 1997, last amendments in 2014[16]) and the Universities Act (introduced in 1995, last amendments in 2014), as teaching and research positions in R&D institutions are, in general, subject to public competition and the selection process also involves evaluation of professional performance. Until the end of 2014, detailed conditions and procedures for organising a competition for research staff in a R&D institution which operates as a state agency or a local authority agency were established by the ministry or corresponding body of the legal person which governs a R&D institution, but since the beginning of 2015 R&D institutions are free to establish their own procedures for the selection process.

In 2013, 20.1% of total population or 49.5% of active population (aged 25-64) was employed in science and technology (Eurostat 2014). The number of researchers was about 7.5 thousands in 2013, which counts for ca 0.57% of total population (Statistics Estonia, 2014). The number of foreign researchers has grown from 58 in 2004 to 393 in 2013 (Statistics Estonia, 2015).

Researchers in Estonia still do not have competitive salaries compared to other European countries (average earnings in Estonia are in general almost three times smaller than EU27[17]). In order to tackle this problem, all State budget-financing instruments related to researchers' salaries were increased by 30% in the 2008 budget. However, the 2009 economic downturn led to salary cut-backs in the research sector (Technopolis Group, 2011) and low salaries are still the main problem.

Since 2004, considerable EU Structural Fund support has been directed to the development of R&D infrastructure, human capital and entrepreneurship which has helped to improve the conditions and has positive effect on the number of foreign researchers (MER, 2014).

The new RDI strategy for 2014-2020 (launched in January 2014) includes measures to further improve the migration policy to increase researcher mobility and to ensure integrated financing of the research groups led by top researchers (see also ch.4.4).

3.2.2 Open, transparent and merit-based recruitment of researchers

The system for open, transparent and merit based recruitment of researchers has been in place since the beginning of the 2000's. There are no barriers to the application of open, transparent and merit based recruitment of researchers and such principles are applied in the recruitment of researchers of the higher education sector and R&D institutions. Estonia's law stipulates that research staff shall be elected by the research council or by

[16] The predecessor of this act "Organisation of Research act" which included the basic principles, was introduced in 1995

[17] Eurostat (2015): Annual net earnings 2012: Estonia – €4588; EU27 – €12697.

the corresponding body of a legal person in public law or a legal person in private law by way of public competition. Universities and R&D institutions are very autonomous in their recruitment policies, but the basic rules are set in the Organisation of Research and Development Act.

From 2015 (relevant amendments in 2014) most of temporary (5 years) posts of research personnel (except research professors) are turned into permanent posts and therefore – as "evaluation by regular selection" disappears - the committee (formed by the R&D institution) must evaluate professional performance at least once in 5 years.

Until the end of 2014, detailed conditions and procedures for organising a competition for research staff in a R&D institution which operates as a state agency or a local authority agency were established by the ministry or corresponding body of the legal person which governs a R&D institution. From the beginning of 2015, R&D institutions will have even more autonomy, as according to amendments to the Organisation of Research and Development Act (relevant amendments made in 2014) they can establish their own conditions for the selection process.

Until the end of 2014, the regulations addressed the following aspects of researchers' recruitment (Riigi Teataja, 2001):

- The vacancy announcement includes the job profile, skills and competences required, and eligibility criteria;

- Information on the selection process and criteria is available for the candidates;

- A minimum time period between vacancy publication and deadline for application is defined;

- Applicants have the right to receive feedback on the results of the recruitment;

- Applicants have the right to appeal against the decision;

- Information on the rules for the composition of selection panels (e.g. number and role of members, gender balance) is available for candidates.

Regulations do not specify the need to include external members (national or international) to the selection panel. Language barrier is not a problem for English speaking researchers as most of the Estonian scientists are quite fluent in it, too. It might be a problem for lecturers, as the number of courses given in English is limited because Estonians have a right to obtain higher education in their mother tongue.

Higher education and research institutes also enjoy the necessary autonomy to organise their activities in the areas of education, research, and innovation, but they are dependent on largely (up to 80%) project-based funding and do not have many alternative sources of funding such as philanthropy etc.

The share of foreign university teachers was 5.1% in the academic year 2010/11 and the share of foreign full-time researchers was 6.7% of all researchers (MER, 2013a). One of the main problems is that researchers in Estonia still do not have competitive salaries as compared to other European countries (average earnings in Estonia are in general almost three times smaller than EU27[18]). Another obstacle to researcher mobility has been the difficulty to obtain Estonian visa/residence permit from countries where Estonia does not have a representation. Also Estonia's research institutions not being sufficiently broadly

[18] Eurostat (2015): Annual net earnings 2012: Estonia – €4588; EU27 – €12697.

known and unattractive conditions have proved to be higher obstacles than expected in bringing foreign top researchers and Doctoral students to Estonia by using human capital development measures (MER, 2012). Since 2004 a significant proportion of EU Structural Fund support has been directed to the development of RD infrastructure, human capital and entrepreneurship. This has helped to improve the conditions and has positive effect on the number of foreign researchers (MER, 2014a) which has grown from 58 in 2004 to 393 in 2013 (Statistics Estonia, 2015).

The new RDI strategy for 2014-2020 (launched in January 2014) includes measures to further improve the mobility policy to increase researcher mobility and to ensure integrated financing of the research groups led by top researchers. Estonian Research Council offers grants for post-Doctoral students via *programme Mobilitas* (introduced in 2008), *post-doctoral research funding* (introduced in 2012) to support young researchers and also the *Start-up research grant* (introduced in 2012) to support promising young researchers to develop an independent research career.

A report "The career of scientists: Estonia in the international system" (Vadi et al, 2012) points out that scientific career is not particularly popular in Estonia because of low wages in the public sector and low demand in the private sector.

3.2.3 Access to and portability of grants

The Estonian Research Council (established in 2012) awards institutional and personal research funding (relevant amendments to the Organisation of Research and Development Act in force since 2012). Grant competitions are open to all permanent residents of the Republic of Estonia and to all citizens of a foreign country, if they have full-time job in Estonian R&D institution (residency is not required as a pre-condition). Grants should be applied for through an Estonian R&D institution. Researchers affiliated in foreign institutions can not apply for Estonian grants, but the Implementation plan for the RD&I Strategy for 2014-2020 includes specific actions to analyse options to ensure the openness of Estonia's research and development programmes for international cooperation and to develop cooperation opportunities with third country researchers and research institutions.

Through the researcher mobility programme Mobilitas postdoctoral researchers and top researchers have a possibility to apply for a grant to carry out a research in Estonia or abroad.

3.2.4 EURAXESS

EURAXESS Estonia has 7 members (Estonian Research Council, Estonian Academy of Sciences, University of Tartu, Tallinn University of Technology, Estonian University of Life sciences, Archimedes Foundation, and Tallinn University) and has Service Centres in biggest Estonian R&D institutions to help researchers and their families to plan and organise their move to a foreign country and provide advice in all matters related to academic mobility. Estonian Research Council is a coordinator and website administrator of Estonian EURAXESS network.

EURAXESS Estonia provides information and assistance to researchers (PhD students, postdoctoral scholars, researchers, and other academic staff) wishing to come to Estonia or for those looking for jobs in research abroad. Information on jobs, entry conditions,

taxation, transfer of social security and pension contributions, finding accommodation and administrative assistance is available. All public universities hosting EURAXESS Services Centres have signed the "Agreement on Good Practice" which supports the internationalisation of Estonia's Higher Education Institutions.

In 2013, EURAXESS contact persons responded to 2941 requests and information bulletin „An International Researcher's Guide to Estonia" was published Estonian Research Council, 2014). In 2011, the number of researchers posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector was 15 in Estonia compared with 47 among the innovation reference group and 24 as the EU average (Deloitte, 2012).

Most publicly funded research jobs are published online. Depending on the institution, either all or a selection of the vacancies is also advertised in English on the institution's website. The EURAXESS Jobs portal is increasingly used in cases where universities are specifically looking for someone from abroad to fill the position.

3.2.5 Doctoral training

Estonia's universities are very autonomous in developing doctoral training curricula. The Rectors' Conference, representing all public universities in Estonia and one private university, have signed a "Quality Agreement of Estonian Universities" (signed in 2011, in Estonian "Eesti Ülikoolide Kvaliteedi hea tava lepe") which specifies quality standards for doctoral studies and encourages international networking and interdisciplinary studies and research.

Doctoral study programmes usually include training in transferable skills to improve researchers' employment skills and competencies (based on the Standard of Higher Education; introduced in 2008, last amendments in 2014). Doctoral schools, curricula development activities, lectures, seminars, practical training classes, laboratory work and individual classes can be developed by each institution with the aim of acquiring knowledge and achieving better learning outcomes for participants.

The new RDI strategy for 2014-2020 (launched in January 2014) aims to pay increased attention to the systematic development of doctoral studies, and ensure competitive financing of doctoral studies.

3.2.6 HR strategy for researchers incorporating the Charter and Code

Universities and other R&D institutions are relatively independent in formulating their HR policies. Only the evaluation mechanisms for assessing researchers' professional performance are in some way regulated by the Organisation of Research and Development Act (introduced in 1997, last update in 2014) and the Universities Act (introduced in 1995, last update in 2014), as teaching and research positions in R&D institutions are subject to public competition and the selection process also involves evaluation of professional performance.

In September, 2011, the Rectors' Conference, representing all public universities and one private university, signed a "Quality Agreement" (in Estonian, "Kvaliteedi hea tava lepe"). Point 10 of the Agreement refers to the implementation of the 'Charter & Code'.

In April 2014, the Estonian Research Council was the first Estonian institution to sign the Declaration of Commitment to the Principles of The European Charter for Research and The Code of Conduct for the Recruitment of Researchers.

As mentioned above, the fact that Estonia's research institutions are not sufficiently broadly known and the unattractive financial conditions have proved to be bigger obstacles than expected in bringing foreign top researchers and Doctoral students to Estonia by using human capital development measures (MER, 2012). The main problem remains that researchers in Estonia still do not have competitive salaries compared to other European countries (average earnings in Estonia are in general almost three times smaller than EU27[19]). Another obstacle to researcher mobility has been the difficulty to obtain Estonian visa/residence permit from countries where Estonia does not have a representation.

3.2.7 Education and training systems

According to the ERAC Peer-review (2012), a lack of educated and skilled labour is a major underlying constraint for growth of productivity and value creation in Estonia's economy, that should be addressed through policy coordination on multiple fronts, including education, particularly adult and secondary/vocational education beside tertiary education, as well as labour and immigration policy supporting RD&I policy.

To respond to the challenge, the *Implementation Plan for RD&I Strategy 2014-2020* includes the following sub-measures that target education[20]:

1.7. Ensure a new generation of researchers and engineers, incl. paying increased attention to the systematic development of doctoral studies, and ensure the competitive-level financing of doctoral studies (incl. PhD grants), continue supporting doctoral studies, the position of junior research fellow and post-doctoral studies (Programme DoRa, Doctoral schools, about €8,500 per year).

2.2. Encourage the mobility of researchers between the academic, public, and private sectors. As regards a researcher's career, place value on the time worked in other sectors and the results achieved there, as well as cooperation with enterprises. Continue supporting doctoral studies that are provided in cooperation with universities and enterprises (financing under 1.7 and 4.1).

2.4. Review the motivation system related to commercialisation in universities, linking it with the main objectives and the financing of universities. Increase the professionalism and impact of commercialisation and reinforce links with other participants in the innovation system – investors, incubators, science parks, etc. Continue the development of competence in the field of knowledge transfer, incl. the training and bringing in of experts, the development of the organisation and quality of knowledge transfer, and the extension of the international contact network. Promote increasing awareness of intellectual property rights among researchers, students as well as the non-academic staff of universities (will be part of institutional development programme for HEIs which is in preparation; budget for 2014-2017 about €56,000).

2.5. Support the development of entrepreneurship studies and new forms of acquisition of entrepreneurship experience by involving more enterprises than before - as lecturers,

[19] Annual net earnings 2012 Eurostat (2015): Estonia – €4588; EU27 – €12697

[20] For measures to improve doctoral training that are already implemented see ch.3.2.5.

practice providers, etc (Measures in development - "Systemic development of entrepreneurship and entrepreneurial skills on all educational levels" and "Development of apprenticeship system in higher and vocational education")

The Estonian Lifelong Learning Strategy 2020 (approved by the Government in 2014) aims to achieve the distribution of students 60/40 as regards general upper-secondary education and vocational education respectively by 2020; provide more work-based learning, including apprenticeships; and increase the proportion of vocational education students in apprenticeships from the current approximately 2.3 % to approximately 7% by 2020 (European Commission, 2014d).

In 2013, a new structure for vocational education and training programmes was introduced by the Vocational Educational Institutions Act. New programmes are based on the national qualifications framework, introducing the learning outcome principle in designing study programmes (with, for example, the opportunity for employers to take part in the development of curricula), modernised management principles for vocational schools, and new accreditation requirements. In addition, the amendments (made in 2013) to the Basic School and Upper Secondary School Act aim to put general and vocational education at an equal footing, and provide primary school graduates with a clear choice between the two paths.

The national curricula for schools[21] sets out cross-curricular topics which focus on equipping people with the capacity to learn and to develop transversal competences such as critical thinking, problem solving, creativity, teamwork, and intercultural and communication skills, and also science, technology, engineering and mathematics, ITC and entrepreneurship. Entrepreneurship education and training is also included in curricula of universities, but is not compulsory as for upper secondary schools.

3.3 ERA priority 5: Optimal circulation and access to scientific knowledge

3.3.1 e-Infrastructures and researchers electronic identity

Electronic identification is widely applied in Estonia, both by the Estonian R&D organisations and the Estonian Research Portal. Remotely accessible services are also widely available and secure. The Programme of Electronic Scientific Information (in Estonian „E-teadusinfo"; launched in 2009) aims to supply Estonia's R&D institutions with scientific information and to acquire access to scientific information and electronic publications for Estonia's research libraries and organisations.

The Estonian e-repository (launched in 2011) is an integrated e-environment created for long-term preservation and availability of digitized resources of the Estonian cultural heritage institutions: libraries, archives, and museums. The e-repository enables to link national heritage collections with the Pan-European library EUROPEANA.

The Estonian Research Information System (ETIS; established in 2006) is developed in a way that would allow it to be used as an open repository, so that the results of research that receive public funding are easily identifiable by appropriate technical means, including through meta-data attached to electronic versions of the research output.

[21] Here for example: National curriculum for upper secondary schools

In 2011, Estonian higher education information and communications technology and research and development activities state programme 2011-2015 (in Estonian "Eesti info- ja kommunikatsioonitehnoloogia kõrghariduse ning teadus- ja arendustegevuse riikliku programmi 2011-2015 (IKTP)") was launched. It is a cooperation programme between the universities, ICT sector, and the state, with the aim to increase the quality of ICT and develop cooperation between different partners.

Estonian Information Technology Foundation for Education (HITSA) was established in April 2013[22]. The mission of HITSA is to provide a high-quality national network infrastructure for Estonia's research, educational and cultural communities. Its services include a permanent Internet connection as well as webhosting, e-mail, consultations in the event of security problems etc.

There is a big number of legislation and national projects on ICT. The Electronic Communications Act (introduced in 2004) implements the EU Regulatory Framework for Electronic Communications. The purpose of this Act is to create the necessary conditions to promote the development of electronic communications networks and communications services while ensuring the protection of the interests of users of such services. Challenges such as personal data security, the scope of personal data use, and identity validation and tracking are addressed in the following legislation: Personal Data Protection Act (introduced in 1996); Copyright Act (introduced in 1992); System of security measures for information systems (passed in 2007); Public Information Act (introduced in 2000); Information Society Services Act (introduced in 2004). Digital Signatures Act (introduced in 2000) and Data exchange layer X-Road (launched in 2001) support identification and interoperability.

3.3.2 Open Access to publications and data

Access to scientific information is facilitated by the Consortium of Estonian Libraries Network and the research libraries that have created very good conditions and access to scientific journals and electronic databases for national researchers. This may be a reason why "Estonian researchers do not feel the need for specific open access policies" (European Commission, 2011).

The free access to the results of publicly funded research is stated by amendments (adopted in 2012) of the Organisation of Research and Development Act and measures have been taken to develop a variety of R&D e-infrastructures (MER, 2014c).

According to the EC report (2014) "State-of-art analysis of OA strategies to peer-review publications", Estonia has a majority (over 70%) of papers in OA. Estonia is publishing more in Open Access journals (ca 13%) and less in Green access (ca 9%), than the other states of Eastern Europe.

Electronic identification is widely applied in Estonia, both by the Estonia's R&D organisations and the Estonian Research Portal. Remotely accessible services are also widely available. The Programme of Electronic Scientific Information (in Estonian „E-teadusinfo"; launched in 2009) aims to supply Estonian R&D institutions with scientific information and to acquire access to scientific information and electronic publications for Estonia's research libraries and organisations.

[22] From May 1st 2013, the Tiger Leap Foundation and the Estonian Education and Research Network (EENet) were transferred to the Estonian Information Technology Foundation and the new name of established organisation will be Information Technology Foundation for Education (HITSA; www.hitsa.ee)

The Implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020" encourages open access and includes the following measures:

2.10. Continue the development of central research information systems and services with the objective of making these convenient for foreign users (incl. state authorities and enterprises) and to allow fast access to research topics, performers and results.

2.11. Encourage open access to publicly financed research results and research data. Support extensions to databases in research institutions and research libraries, and ensure access to the most important research databases.

4. Innovation Union

4.1 Framework conditions

In general, the rules for starting up and running a business are simple and the legal framework is transparent and up-to-date. The only tax incentive for innovation is the special feature of corporate income tax in Estonia - only dividends are taxed. If earnings are re-invested into the company, they are tax-exempt. There is no other specific law or regulation to promote business investment in research and innovation, but there are a number of measures to support innovative enterprises (see 4.2-4.7). Estonia has a system of intellectual property rights that is well developed from a legal perspective (OECD, 2011). Estonia is also in the process of renewing its patent and intellectual property rights system (see also ch. 4.3).

As concluded in the study "Demand-side innovation policy in Estonia: rationales, limits and future paths (Kattel et al., 2013) "demand-side innovation policy has so far not been actively pursued and implemented in Estonia".

The Ministry of Economics and Communications has defined the *"development of demand-side policies"* as one of three major policy instruments in the "Entrepreneurship Growth Strategy 2014-2020" (launched in October 2013). According to the strategy, the state will be an active innovation partner for entrepreneurs as a client for innovative solutions, while fostering the development and procurement of innovative solutions and implementation of demonstration projects. The implementation plan of the strategy for 2014-2017 includes survey, concept development, and after that - implementation of the measures.

4.2 Science-based entrepreneurship

A number of measures to facilitate knowledge transfer and the creation of university spin-offs (but also encourage partnerships and interactions between research institutions and the private sector; see ch. 4.4) have been under implementation since 2008-2009. The following measures are funded by MEAC and implemented by Enterprise Estonia Foundation:

- Cluster development Programme – aiming to increase the value added of the companies and the sales of the products/services and exports; to promote cooperation between companies of the same and different sectors, and between companies and research establishments.
- Knowledge and technology transfer baseline funding (SPINNO Programme) - to improve the quality and volume of application of the intellectual property developed in Estonia's research and development establishments and institutions of applied higher education for commercial purposes through the professional and effective provision of services of transfer of knowledge and technology; to strengthen human resources and their mutual cooperation mechanisms required for the provision of the services of transfer of knowledge and technology in Estonia's research and development establishments and institutions of applied higher education.
- Technological development centres for 2014-2020 (opened in Nov. 2014, the 3rd consecutive programme, the 1st started in 2004) – to develop the technologies, products and services necessary for increasing international competitiveness and smart

specialisation; develop internationally high-level and competitive technological development centres that are independent of national financial instruments, and provide Estonia's entrepreneurs with opportunities for co-operation in the development of new technologies, products and services; increase qualified staff numbers in business-oriented R&D, and their movement between businesses and research institutions.

- Programme "Start-up Estonia" (in Estonian "Programm "Start-up Estonia"") for new innovative enterprises. Start-Up Estonia is a development plan that will speed up the development of innovative start-up companies by covering aspects such as awareness, knowledge, skills, and financing and co-operation with R&D institutions. Its objective is to provide training and mentoring to start-ups to develop their business models, products or services and validate such models, products or services on the market, and also to help start-ups expand their international network and provide them with financial investment. The accelerator must also have broader impact on Estonia's start-up ecosystem increasing Estonian start-ups' visibility in the global start-up ecosystem and drawing international mentors' knowledge to Estonia's start-up ecosystem.
- Entrepreneurship competition "Ajujaht" ("*Brain-hunt*" in Estonian) to support new innovative ideas to find funding, test ideas, start a business, etc. The entrepreneurship competition is open to both ideas in their initial stages and more specific business plans. The only requirement is that the products or services competing in Ajujaht should not have earned any sales revenue during the six months prior to submission deadline and the idea must be innovative or solve existing problems in an innovative way. Ajujaht is co-funded by the European Social Fund and the prize money is contributed by several sponsors and partners.
- Investments into test- and semi-industrial laboratories (in Estonian "Katse- ja pooltööstuslikud laborid) - establishment of test- and semi-industrial laboratories to provide services to other enterprises for testing new products (including high-tech laboratories as biotech and nanotech[23]).

Attracting venture capital and business angels to finance research in universities is a novel idea for Estonia. To address this challenge the Implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020" includes the following measure:

Review the motivation system related to commercialisation in universities, linking it with the main objectives and the financing of universities. Increase the professionalism and impact of commercialisation and reinforce links with other participants in the innovation system – investors, incubators, science parks, etc. Continue the development of competence in the field of knowledge transfer, incl. the training and bringing in of experts, the development of the organisation and quality of knowledge transfer, and the extension of the international contact network. Promote increasing awareness of intellectual property rights among researchers, students as well as the non-academic staff of universities.

4.3 Knowledge markets

Estonia views its intellectual property rights (IPRs) regime as a component of an articulated national strategy on innovation, and has substantially improved its quality of enforcement

[23] Examples of laboratories: Bio-Competence Centre of Healthy Dairy Products; Tartu Science Park Nanolab

over recent years. Compliance related activities in Estonia are closely interlinked with those of the European Union and the EU's relationship with the WTO. Estonia has a system of intellectual property rights that is well developed from a legal perspective. Significant amendments and modifications have been made in recent years to bring the Estonian system closer to the international norms of developed economies, particularly during the process of adapting or amending national legislation to become a member of the European Union (OECD, 2011).

Estonia is also in the process of renewing its patent and intellectual property rights system. The Ministry of Justice established an Expert Group on the Codification of the Intellectual Property Law. The whole intellectual property system will be thoroughly examined. Although the plan was to create new laws, after thorough analysis the Expert group reached a conclusion that right now it is more feasible to wait and see what will be decided in EU and till then make some necessary amendments to the existing law (Ministry of Justice, 2015). The Agreement on a Unified Patent Court has been signed by the Government of Estonia in 2013, but has not yet been ratified by the Parliament.

In January 2013, a new institution was started – the Estonian Intellectual Property and Technology Transfer Centre, which took over the activities of the Estonian Patent Information Centre. The Estonian Intellectual Property and Technology Transfer Centre (EIPTTC) is a foundation established by the Estonian Chamber of Commerce and Ministry of Economic Affairs and Communication. EIPTTC offers a wide variety of intellectual property and technology transfer support services, training and education. EIPTTC collection of documents and online search possibilities guarantee the possibility of carrying out assessment of novelty and state of art of applications for registering the subjects of legal protection of industrial property.

EIPTTC contains a public library. The library's basic functions are collecting, storing and making available for public the stock of the domestic and foreign documents in the area of protection of the industrial property.

A non-profit society, Estonian National Group International Association for the Protection of Intellectual Property, was founded in 1992. The aims of the Group are participation in the activities related to the legal protection of intellectual property in the Republic of Estonia; participation in the examination and comparison of international legislation as carried out by AIPPI, with the aim of establishing the possibilities for improving and unifying the intellectual property protection legislation in different countries; and to relay to members topical information on various trends and developments of the legal protection of intellectual property.

In 2004, the Republic of Estonia acceded to the protection systems of the Community trade marks and designs. The Estonian Patent Office takes part in several cooperation and convergence programme projects of the OHIM and has joined the European Trade Mark and Design Network.

Issues of competitiveness in R&D activities are regulated by the "General permission" (block exemption[24]) to enter into a R&D agreements which restricts or may restrict

[24] A block exemption is general permission granted by a regulation of the Government of the Republic on the proposal of the Minister of Economic Affairs and Communications to enter into a certain category of agreements, engage in a certain category of concerted practices or adopt a certain category of decisions which complies with the conditions provided for in § 6 of Competition Act and restricts or may restrict competition

competition" (adopted in 2011, in Estonian "Konkurentsi kahjustavate või kahjustada võivate teadus- ja arenduskokkulepete sõlmimiseks loa andmine (grupierand).

Universities have been free to sell their intellectual property. The implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020" also includes a measure (2.4) to promote commercialisation of intellectual property (review the motivation system related to commercialisation in universities) and promote increasing awareness of intellectual property among researchers, students as well as the non-academic staff of universities. However, this measure is relatively vague and has not been supported with specific policy actions to support the market for parent sales and/or licensing.

4.4 Knowledge transfer and open innovation

A number of measures to facilitate the partnerships and productive interactions between research institutions and the private sector are under implementation since 2008-2009. Counselling on measures is provided also in county development centres. The following measures are funded by MEAC and implemented by Enterprise Estonia Foundation:

- Cluster development Programme (see ch. 4.2)
- Knowledge and technology transfer baseline funding (SPINNO Programme) (see ch. 4.2)
- Programme "Start-up Estonia" (in Estonian "Programm "Start-up Estonia") for new innovative enterprises (see ch. 4.2)
- Innovation voucher grant (for SMEs, knowledge and technology transfer, and co-operation with R&D institutions) (see ch. 4.2)
- Technological development centres for 2014-2020 (opened in Nov. 2014) (see ch. 4.2)

The volume (profit from contracts) of "partnership" and joint collaborative research agendas signed between universities and enterprises was €6.2m in 2012. The percentage of researchers in public universities (the four largest) with a share in spin-off enterprises was 15% in the end of 2011 (Lukason et al, 2014).

In 2012, the revenue of spin-off enterprises with the shareholdings of four Estonia's largest universities (Tartu University, Tallinn Technical University, Tallinn University and Estonian University of Life Sciences) and their employees in Estonia's companies was €11.7m and the number of spin-offs was 19 (Lukason et al, 2014).

The share of doctorate holders employed in the business enterprise sector was 3% in 2009 (Eurostat 2015).

The number of patent applications by government sector in 2007 was 0.745 per million of population (Eurostat, 2015).

In the new, 2014-2020 programming period, Estonia's approach to R&I is built around two strategies: the RD&I strategy "Knowledge Based Estonia 2014-2020" (approved by the Parliament on the 21st of January, 2014) and the "Entrepreneurship Growth Strategy 2014-2020" (adopted by the Government on 31st of October, 2013). One of the aims of these two strategies is enhancing national as well as international co-operation of Estonian R&D institutions and enterprises and reinforcing the framework for co-operation between the private and public sector.

The implementation plan for RD&I strategy for "Knowledge Based Estonia 2014-2020" (approved by the Government in September 2014) includes following set of relevant measures:

Measure 2: Increasing the social and economic benefit of RD

2.2. Encourage the mobility of researchers between the academic, public and private sectors. As regards a researcher's career, place value on the time worked in other sectors and the results achieved there, as well as cooperation with enterprises. Continue supporting doctoral studies that are provided in cooperation with universities and enterprises.

2.3. Support the joint use of research infrastructure among enterprises and research institutions, and develop rules for the joint use of infrastructures.

2.4. Review the motivation system related to commercialisation in universities, linking it with the main objectives and the financing of universities. Increase the professionalism and impact of commercialisation and reinforce links with other participants in the innovation system – investors, incubators, science parks, etc. Continue the development of competence in the field of knowledge transfer, incl. the training and bringing in of experts, the development of the organisation and quality of knowledge transfer, and the extension of the international contact network. Promote increasing awareness of intellectual property among researchers, students as well as the non-academic staff of universities.

2.5. Support the development of entrepreneurship studies and new forms of acquisition of entrepreneurship experience by involving more enterprises than before - as lecturers, practice providers, etc.

2.7. Support enterprises in the development of products and services of high added value in cooperation with universities and RD institutions, incl. continuing, also in traditional economic sectors, to increase added value through RD and improve the strategic development capacity of enterprises.

Measure 3: Smart specialisation is the basis for RDI in changing the structure of economy

3.3. Develop activities of cooperation networks between enterprises and RD institutions in the growth areas of Smart Specialisation (incl. centres of competence and clusters).

3.5. Increase the capacity of enterprises through commencing to use information and communication technology and other technological developments. Support the strategic use of design in enterprises in order to increase the added value of products and services, and achieve international visibility.

3.6. Increase the role of the public sector as the leader of innovation in enterprises under the fields of growth of smart specialisation, i.e. in commissioning and initiating RD and innovation. The innovations include innovative procurements, development activities of enterprises under the leadership of the public sector, design of public services, public and private sector partnership, demonstration projects, as well as the infrastructure and information technology solutions required.

4.5 Innovation framework for SMEs

In Estonia, 99.8% of non-financial business sector enterprises are SMEs (European Commission, 2014e and PRAXIS, 2012) and all start-ups are small, so most of support

measures have earlier targeted SMEs; to date, most measures do not differentiate between SMEs and other enterprises.

Support is mainly given via open calls and should be applied through an Estonian enterprise or R&D institution. The allocation of competitive funds involves an international peer evaluation of the proposals and selection criteria are straightforward.

The following measures are funded by MEAC and implemented by Enterprise Estonia Foundation:

- Business Incubation Programme
- Competence Centre Programme
- Cluster development
- R&D grants (in Estonian, Teadus- ja arendustegevuste projektide toetus)
- Innovation Voucher grant
- Investments into test- and semi-industrial laboratories (in Estonian "Katse- ja pooltööstuslikud laborid)
- Involvement of innovation staff (in Estonian "Arendustöötaja kaasamise toetus")
- Development Grants to Manufacturing Companies
- Knowledge and technology transfer baseline funding (SPINNO Programme)
- Prototyping Centre grants (in Estonian, Prototüüpimiskeskuste toetus)
- Programme "Start-up Estonia" (in Estonian "Programm "Start-up Estonia") for new innovative enterprises

Public-private venture capital investments through the Estonian Development Fund have given significant impetus for high-growth internationally oriented start-ups in Estonia.

The Baltic Innovation Fund (BIF) is a Fund-of-Fund initiative launched by the EIF in close co-operation with the Governments of Lithuania, Latvia and Estonia in 2012 to boost equity investments made into Baltic Small and Medium sized enterprises (SMEs) with high growth potential.

The OECD Economic Review on Estonia (2009 and 2012) concluded that Estonia can be considered to have one of the most open and competitive economies in the world. The dynamism of the business environment is reflected in high rates of firm and job creation, also relative to other European emerging market economies. Estonia is particularly highly regarded in the area of network readiness, and also scores relatively highly (for its level of development) on measures of corporate governance and transparency.

The "Entrepreneurship growth strategy for 2014-2020" (launched in October, 2013) is targeting issues of "tailored support" to meet the needs of companies, particularly SMEs, and keeping the bureaucracy to a minimum.

Funding schemes are regularly evaluated and benchmarked against comparable schemes in other countries by international expert groups, commissioned by responsible ministries (mainly MER and MEAC).

Enterprise Estonia, which administers R&I support to enterprises, including SMEs, participates in the following programmes: HORIZON2020, EUREKA, EUROSTARS, COMPERA, MANUNET, LEAD ERA, Enterprise Europe Network.

Estonia enhanced its insolvency process in 2010 by establishing a new reorganization procedure to enable financially distressed companies to restructure their debt and apply other means to restore financial health and profitability. In 2011, amendments to the Bankruptcy Act increased the chances that viable businesses will survive insolvency by improving procedures and changing the qualification requirements for insolvency administrators (World Bank Group, 2015).

4.6 Venture capital markets

No special tax incentives are given to the R&D and innovation investments or to venture capital funds except that the companies' income is free of tax to the extent that they reinvest their profit. There are no instructions whether the reinvestment has to be made in R&D and innovation or anywhere else, the only criteria are for the investments to be made into the development of the company. The taxation policy of the Government of Estonia follows the rule of taxing everything similarly and allowing as few exemptions as possible – consequently, the idea of specific tax incentives for R&D and innovation financing has not been supported by the Government so far.

Foundation KredEx's mission is to facilitate the increase of competitive strength of Estonia's companies by improving the availability of financing and managing credit risks by providing credit guarantees, and the improvement of the energy efficiency of the housing sector by expanding financing possibilities and offering financing solutions aimed at promoting energy efficiency as well as the use of energy from renewable sources.

An innovation oriented projects promoter is the Development Fund, a public law entity, founded by the Estonian Parliament in 2007. Development Fund (together with the private sector) performs risk capital investments into the starting and growth-oriented technology companies and carries out socio-economic and technology foresight exercises. Development Fund started investments in June 2008 and by 2013, 16 investments have been made in the total amount of 7 million euro. Based on State Budget Act 2011, €12.5m were allocated to the fund for investment activities and €6.4m in 2012.

The Baltic Innovation Fund (BIF) is a Fund-of-Fund initiative launched by the EIF in close co-operation with the Governments of Lithuania, Latvia and Estonia in 2012 to boost equity investments made into Baltic Small and Medium sized enterprises (SMEs) with high growth potential. BIF represents a €40m investment by EIF with each Baltic Government committing €20m through their respective national agencies (INVEGA in Lithuania, KredEx in Estonia and LGA in Latvia).

BIF will invest €100m into private equity and venture capital funds focusing on the Baltic States over the next four years through a 'fund of funds' process to attract additional private finance and implement the best market standards for equity investing in businesses.

Business Angels Network (EstBAN) was established in 2012. EstBAN is a full member of the European Trade Association for Business Angels, Seed Funds, and other Early Stage Market Players (EBAN) and Estonian Venture Capital Association (EstVCA). EstBAN is supported by Estonian Development Fund and European Union Regional Development Fund

and has close cooperation with the Finnish Business Angels Network (FiBAN), Latvian Business Angels Network (LatBAN), and St-Petersburg Business Angels Network (SOBA).

4.7 Innovative public procurement

To date, no national target has been introduced on public procurement of innovative goods and services. Government Office of Estonia commissioned a qualitative survey "Mapping the public procurement field in order to aid innovative and sustainable public procurements and joint procurements" in 2012, which showed that public tenders did not include clear innovation related criteria. Also no quantitative data is available on public tenders launched for joint public procurement of innovation. Development of national procurement policy measures is addressed in the Implementation plan for the "Entrepreneurship Growth Strategy 2014-2020" (starting with survey and drafting of the concept). The Implementation Plan for the RD&I Strategy for 2014-2020 also includes a relevant measure (responsibility of MEAC):

3.6. Increase the role of the public sector as the leader of innovation in enterprises under the fields of growth of smart specialisation, i.e. in commissioning and initiating RD and innovation. The innovations include innovative procurements, development activities of enterprises under the leadership of the public sector, design of public services, public and private sector partnership, demonstration projects, as well as the infrastructure and information technology solutions required.

5. Performance of the National Research and Innovation System

5.1 Performance of the National Research and Innovation system

Estonia is small compared to most other EU countries, and this reflects on the size of infrastructure and funding opportunities. Under EU programming period 2007-2013 funding, research infrastructure was developed quite extensively. Out of 11 R&D facilities of the R&D and higher education infrastructure investment plan adopted by the Government of the Republic, 3 facilities have been completed and paid for, 6 are almost complete and also partially in use, and only 2 are still under construction. In general, present activities concerning infrastructure investments have been sufficient to cover the insufficient investments from the previous programming periods. In the future, the main focus has to be on ensuring the sustainability of such infrastructure.

Trends for patenting and for scientific publications are positive. The number of international scientific co-publications per million of population increased from 501 in 2009 to 831 in 2012 and patents applications per million of population increased from 25 in 2008 to 32 in 2012 (MER, 2014). The main reason for relatively low number of patents is related to the less favourable structure of economy and industry, high costs of patenting, and its complexity and legal uncertainty (MER, 2011).

Based on Thomson Reuters Web of Science' number of publications per full-time researcher, Estonia is on an average position compared to some other EU member states, ahead of Hungary, Finland, Lithuania and Latvia, and falling behind Ireland, Slovenia, and Sweden. In 2012, Estonia's respective indicator improved, compared to 2011 (0.39 versus 0.35 publications per researcher) (MER, 2013).

Estonia's position in the Innovation Union Scoreboard (2014) improved in 2013 compared to previous year. It ranked 13th (2 places below the EU28 average) and is the highest growing Innovation follower. Estonia also maintained its position in the innovation followers group.

In Finance and support, Estonia is the overall leader in this dimension followed closely by Denmark, Finland and Sweden. However, Estonia's strong performance has to be interpreted with care as the score for this dimension is based on one indicator only (R&D expenditures in the public sector) as data on venture capital investments are not available.

Estonia's Innovation performance has been increasing steadily since 2007 although the growth rate has slowed down since 2009. Estonia's performance is above the EU average for International scientific co-publications, Non-R&D innovation expenditures, Innovative SMEs collaborating with others and Community trademarks. Performance has been well below the EU average for Non-EU doctorate students and License and patent revenues from abroad.

Estonia has experienced growth for most indicators included in the IUS 2014. Highest growth rates were observed for Community designs, Community trademarks, and Non-EU doctorate students. Largest growth declines are observed for SMEs with Marketing and/or Organisational innovations, SMEs innovating inhouse, and Non-R&D innovation expenditures.

The biggest problem is still the economic effect of innovation, where Estonia holds the 22nd position. Considering the criterion of open, excellent and attractive research system, Estonia holds 16th position as well as under the human resources criterion. Therefore, the main challenges for Estonia are creating a business environment necessary for increasing export intensity and employment in medium and high-tech industry and knowledge-intensive services.

Table 2: Assessment of the Performance of the National Research and Innovation System.

1. ENABLERS	Year	EE	EU
Human resources			
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	2011	1.30	1.70
Percentage population aged 30-34 having completed tertiary education	2012	39.10	35.80
Open, excellent and attractive research systems			
International scientific co-publications per million population	2012	831.47	343.15
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	2009	8.49	10.95
Finance and support			
R&D expenditure in the public sector as % of GDP	2012	0.90	0.75
Venture capital (early stage, expansion and replacement) as % of GDP	2012	N/A	0.08
2. FIRM ACTIVITIES			
R&D expenditure in the business sector as % of GDP	2012	1.25	1.31
Linkages and entrepreneurship			
Public-private co-publications per million population	2011	25.00	52.84
Intellectual assets			
PCT patent applications per billion GDP (in PPS€)	2010	2.20	3.92
PCT patent applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	2010	0.57	0.85
3. OUTPUTS			
Economic effects			
Contribution of medium and high-tech product exports to trade balance	2012	-2.94	1.27
Knowledge-intensive services exports as % total service exports	2011	36.38	45.26
License and patent revenues from abroad as % of GDP	2012	0.06	0.59

Source: European Commission, IUS Database (2014).

On the average in 2012, Estonia produced 16.65 publications per 10,000 inhabitants, slightly above the EU28 average (13.8). They are also internationally oriented with 51.9% of publications internationally co-published. In 2012, Estonia had about 864 international scientific co-publications per million population which is 4 times more than in Latvia (213) and 2.7 times more than in Lithuania (324), but 1.7 times less compared to Finland (1490). In the period 2002-2012, a slightly over 10% of the Estonian scientific publications were in the top 10% most cited publications worldwide in comparison with 11% of top scientific publications produced in the EU28 (Science Metrix, 2014)[25]. The share of public-private co-publications in Estonia was 1.1% in the period 2008-2013 against 2.8% for the EU28[26].

[25] These publication data are based on Elsevier's Scopus database. ScienceMetrix, Analysis and Regular Update of Bibliometric Indicators, study conducted for DG RTD. They represent an update of the data

5.2 Structural challenges of the national R&I system

The ERAC Peer-Review of the Estonian R&D system (2012) marks that Estonia's research policies have been driven by a steady development based on quality, excellence and competition. The *main challenge for Estonia* is *to further develop its research and innovation system in ways that will make a difference for the economy at large* without in the process dismantling the solid innovation assets created that will matter more in the medium- to long-term than they do now.

ERAC Peer-Review points to the challenges and suggests focusing more on R&D as a means to achieve economic and societal goals, link better with Estonia 2020 strategy, strengthen co-ordination and cooperation, focus on fewer key areas, and harness RD&I measures to drive structural change in the economy.

According to the peer-review, the main challenges of the R&D system are as follows:

1) **Innovation system detached from the vast part of the economy and, as a consequence, delivers relatively little value for the average Estonian**

This is the result of the innovation system being focused on areas other than those that dominate Estonia's economy today; it is not a simple failure to commercialise scientific activity. These observations also raise the question whether the past efforts to build an innovation system have properly addressed the indigenous structural features of the Estonia's economy. The policy has aimed to develop a science-driven system in order to create innovation. It succeeds at that to a large degree, but is still incapable of supporting the upgrading of Estonia's existing economy. Suggestion is to invest more strongly in creating public-private partnerships in innovation and to broaden the scope of policy to include instruments that support the upgrading of traditionally strong industries.

2) **Challenge to further develop RD&I system to make a difference in the economy & society at large**

Estonia's RD&I policy has so far been rather detached from the practical needs of the industry. Partially this has been due to the lack of absorptive capacity of the industry. However, in the future the RD&I policy should more strongly contribute to the upgrading of the low-tech and low-added-value industries, and thereby drive the much needed structural change in the economy. The support instruments and the performance of RD&I should be developed and measured against their anticipated impact on the society, such as changes in economic structures, employment, health, or education-base.

3) **Upgrade the role of Estonia's industry in the global value chains**

To raise the productivity and value added of the economy, efforts must be made to upgrade the role of Estonia's industry in the global value chains by means of stimulating RD&I, with the emphasis on the D and I. Innovation should not be understood narrowly as just technology and new product development, but also as process and manufacturing development, training, IPR development, organisational innovation and service development that all contribute to productivity and value creation.

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displayed in the table below. See also http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=other-studies

[26] SciVal 2014, Scopus based publication indicators derived from Elsevier's SciVal platform, www.scival.com last accessed December 2014.

4) Lack of trained personnel hinders growth and investments

Lack of trained personnel hinders domestic growth as companies need to start growing outside Estonia early on as the resources in home country are exhausted easily, and lack of resources also acts as a disincentive for foreign investment, negating the effect of favourable industry conditions. In short, a lack of educated and skilled labour is a major underlying constraint for growth of productivity and value creation in Estonia's economy, that should be addressed through policy coordination on multiple fronts, including education, particularly adult and secondary/vocational education beside tertiary education, as well as labour and immigration policy supporting RD&I policy.

Table 3. Challenges of R&I system

Challenge	Policy measures/actions addressing the challenge	Assessment in terms of appropriateness, efficiency and effectiveness
1. Innovation system detached from the vast part of the economy and, as a consequence, delivers relatively little value for the average Estonian	1. RD&I Strategy focuses specifically on exiting large-scale support schemes, including analysing possibilities for replacing current direct support actions gradually with financing instruments.	Implementation plan for the new RD&I Strategy for 2014-2020 was approved just in September, 2014, so it is too early to give assessment
2. Challenge to further develop RD&I system to make a difference in the economy & society at large	2. RD&I Strategy sets clearer focus on national RD&I programmes – national RD&I programmes are among the main instruments in implementing strategic priorities, therefore, national programmes need to be clearly connected with strategic priorities – reduce their number and make implementation more efficient.	Implementation plan for the new RD&I Strategy for 2014-2020 was approved just in September, 2014, so it is too early to give assessment
3. Upgrade the role of Estonia's industry in the global value chains	3. RD&I Strategy focuses on a limited number of growth areas, on the basis of the Smart Specialisation concept. These fields need to be given priority in coordinated development using research and development and innovation as well as enterprise policy measures in cooperation with sectoral ministries.	Implementation plan for the new RD&I Strategy for 2014-2020 was approved just in September, 2014, so it is too early to give assessment
4. Lack of trained personnel hinders growth and investments	4. RD&I Strategy aims to finding opportunities for better involvement of the people, increasing their competences, as well as attracting and bringing in additional competences from abroad.	Implementation plan for the new RD&I Strategy for 2014-2020 was approved just in September, 2014, so it is too early to give assessment

5.3 Meeting structural challenges

One programming period is nearly completed and new measures are being initiated for 2014-2020. The RD&I Strategy for 2007-2013 focused on the development of knowledge and technology transfer, modernisation of infrastructure and technology, internationalisation of research (incl. researchers' mobility) and business, supporting of start-up companies, and developing cooperation between business and academia.

The ERAC Peer-review (2012) points out the following aspects concerning the governance and funding of research and innovation in Estonia[27]:

1) The growth of RD&I investments has been impressive, but questions remain as to whether the current trajectory is sustainable. While BERD has been growing steadily, an increasing share of RD&I expenditure is financed through public sources, namely from European Structural Funds. In 2011 and 2012, 64% of all public sector RD&I funding was financed by Structural Funds. Most of the loans and guarantees that KredEx passed for business development and RD&I, were funded from ERDF or ESF. As national funding had not increased as much as expected and as was agreed in the strategy (as a consequence of economic recession), the share of EU Structural Funds in the general R&D budget has increased significantly in recent years. As the funding from the Structural Funds is specifically targeted for infrastructure development, mobility schemes and internationalisation, the possibilities to use it for other general needs, such as researchers' salaries, maintenance costs, and indirect costs are limited. Much of the growth in RD&I funding this far is explained by filling in the gap in infrastructure investment. To improve sustainability of RD&I funding, better focus and balance between human capital and infrastructure investment are needed, as well as thinking and planning devoted to avoiding dependency on EU Structural Funds.

2) Innovation policy seems high on Estonia's policy agenda and RD&I policy is systematically planned, however, there is need for more active RD&I policy coordination. RD&I policy making is in general restricted to MER and MEAC, and coordination between the ministries has been insufficient. Apart from the MER and MEAC, other ministries are not permanently represented in the Research and Development Council, the Research Policy Committee[28] or the Innovation Policy Committee. It appears that the Research and Development Council has not sufficiently followed up its work as clear results of the advice given by the council are hard to identify and attribute, as yet.

The connection between sector ministries, societal stakeholders and the core RD&I system is insufficient. Also, the participation and activity of other stakeholders and societal partners (entrepreneurs, civil society organisations) in advisory bodies is low and thereby limits the capability of advisory bodies and stakeholders to define the social demand for RD&I policy. That is probably one of the reasons why it is difficult to design RD&I policies oriented towards addressing major societal challenges as the "owners" of these challenges are not involved sufficiently or they cannot define the social demand for R&D policy clearly enough.

[27] Other recent studies have made similar conclusions (MEAC, 2012: Estonia's enterprise and innovation policy's evaluation 2012; National Audit Office, 2012: Activities of the state in promoting key areas of research and development; MER, 2013: Report on achieving the objectives and implementing the strategy in 2012)

[28] From April 2014, MER, MEAC and the Ministry of Finances, Ministry of Social Affairs, Ministry of Internal Affairs and Ministry of Agriculture are represented in Research Policy Committee (The procedure for the formation and the rules of procedure of the Research Policy Committee)

3) The implementation of research and innovation policies is fragmented and therefore multiple foundations and agencies implement policies through partly overlapping funding instruments, which poses a hurdle for applicants. At least partly overlapping or complementary instruments are offered by e.g. Enterprise Estonia and KredEx. Currently the same industrial RD&I projects are funded from different sources as separate projects during the life time of the idea to market. This results in large project administration overheads and reduced impact of funding. Different grant award criteria and gaps between the instruments lead to funding discontinuities. Instruments have funded plans/activities rather than delivery. Coordination of international cooperation is weak. Although a lean public sector is an aim by itself, the shortage of resources in a small country may become a challenge in solving problems that need stronger public intervention and coordination, e.g. setting up and implementing cross-sector instruments. Handling systemic/cross cutting issues is hindered because of a lack of resources and insufficient coordination processes between the ministries, e.g. launching sector/thematic programmes has proved to be challenging.

4) There is a need to strengthen ownership and implementation of national RD&I programmes. Currently there is a lack of clear 'ownership' for the national RD&I programmes, which makes their implementation challenging. Sectoral ministries have not been sufficiently engaged in objective setting and administration of RD&I programmes. E.g. the Health RD&I programme is run currently outside the Ministry of Social Affairs although MSA would have the best expertise in the substance area. Furthermore, there is lack of strategic RD&I programmes. Ownership of the objectives is outside the research system, and objectives do not engage all the players.

5) There is a need to put more focus on increasing the impact of RD&I investments. There is a lack of knowledge on the impact of RD&I funding. There are relatively few evaluations for RD&I programmes and instruments, and even the few are executed by the ministries themselves. Better monitoring of the progress and assessment of impact of programmes and other RD&I support measures is needed. The establishment of the Estonian Research Council in 2012 and its monitoring and evaluation responsibilities was a welcome introduction to this end.

The knowledge-intensive private sector is very narrowly-based and needs specific measures. There are around 400 companies actively conducting R&D in Estonia and around 10% of them account for most of the RD&I investments. In the future, RD&I policy needs to address how to support the best-performing 10% and at the same time, attract and help the rest 90% of domestic companies to get engaged with research and development work in order to move up in the value chain and to gain competitiveness.

While RD&I Strategy for 2007-2013 concentrated on capacity building, the new strategy for 2014-2020 concentrates on making social and economic effects on capacities.

RD&I Strategy for 2014-2020 has been compiled with the aim to respond to challenges listed in ch.5.2, and aims to ensure the high level and diversity of research; increase the social and economic benefit of RD; significantly improve the share of employment and added value of entrepreneurship in the economy and exports on the areas of Smart Specialisation (ICT horizontally through other sectors, health technologies and services, and more effective use of resources); increase the participation and visibility of Estonia in international RDI cooperation (see more in 2.2).

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Annex 2 – Abbreviations

BERD	Business Expenditures for Research and Development
ERA	European Research Area
ERA-NET	European Research Area Network
ERAC	European Research Area Committee
ESA	European Space Agency
ESF	European Science Foundation
ESFRI	European Strategy Forum on Research Infrastructures
ESS	European Social Survey
EU	European Union
EU28	European Union including 28 Member States
FDI	Foreign Direct Investments
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HE	Higher Education
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
ICT	Information and communications technology
IP	Intellectual Property
IPR	Intellectual Property Rights
IPTS	Institute for Prospective Technological Studies
JRC	Joint Research Centre-Institute for Prospective Technological Studies
MEAC	Ministry of Economic Affairs and Communication (in Estonian "Majandus- ja Taristuministeerium")
MER	Ministry of Education and Research (Haridus- ja Teadusministeerium)
MF	Ministry of Finance (Rahandusministeerium)
MSTI	Main Science and Technology Indicators
PPP	Public Private Partnership
PPS	Purchasing Power Standard
PRO	Public Research Organisations
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
RD&I	Research, Development and Innovation
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
SF	Structural Funds
SME	Small and Medium Sized Enterprise
S&T	Science and technology
TTU	Tallinn University of Technology (Tallinna Tehnikaülikool)
UT	University of Tartu (Tartu Ülikool)
VC	Venture Capital
WIPO	World Intellectual Property Organisation

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European Commission
EUR 27307 EN – Joint Research Centre – Institute for Prospective Technological Studies

Title: RIO Country Report Estonia 2014

Author: Ruuta Ruttas-Küttim

Luxembourg: Publications Office of the European Union

2015– 54 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-48967-9 (PDF)

doi:10.2791/01066

LF-NA-27307-EN-N

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ISBN 978-92-79-48967-9

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